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Anzeigesteuerungsprogramm, Anzeigesteuerungsvorrichtung, Anzeigesteuerungsverfahren und Anzeigesteuerungssystem

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- **Miao Song ET AL: "A stereoscopic OpenGL-based interactive plug-in framework for Maya and beyond", Proceedings of the 8th International Conference on Virtual Reality Continuum and its Applications in Industry, VRCAI'09, 1 January 2009 (2009-01-01), page 363, XP055180814, New York, New York, USA DOI: 10.1145/1670252.1670333 ISBN: 978-1-60-558912-1**

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Description

BACKGROUND OF THE INVENTION

Field of the invention

[0001] The present invention relates to a display controlling program, a display controlling apparatus, a display controlling method and a display controlling system. More specifically, the present invention relates to a display controlling program, a display controlling apparatus, a display controlling method and a display controlling system which perform a display control on a display capable of making an autostereoscopic display.

Description of the related art

[0002] Conventionally, as an example of this kind of an apparatus, a stereoscopic image displaying apparatus in a parallax barrier system provided with a liquid crystal parallax barrier arranged in front of a liquid crystal display like a Japanese Patent Laid-open No. 3-119889 is known. In the related art, a voltage applied to the liquid crystal parallax barrier is controlled so as to change the transmittance at a light shielding portion, to thereby switch between a 2D video display and a 3D video display.

[0003] Generally, a suitable viewing position of the autostereoscopic display is restricted, and if a user is off the suitable viewing position, a 3D video image looks double or blurred without being viewed in a three-dimensional manner. For example, if a display is made as in environmental software, the user can browse both within and outside the suitable viewing position while freely moving, resulting in a problem.

[0004] In that respect, in the related art, a 3D display is performed at the suitable viewing position, and a 2D display is performed at a position except for the suitable viewing position, and thus, the user can browse comfortably in any position, but the user has to manually switch between the 2D display and the 3D display every movement, resulting in much labor. EP 1 406 163 A2 by Sharp Kabushiki Kaisha relates to an electronic equipment provided with 2D (two-dimensional) and 3D (three-dimensional) displaying functions, an easily viewable 2D image screen and an enjoyable 3D image screen are switched and displayed with a simple key operation.

[0005] Miao Song ET Al: A stereoscopic OpenGL based interactive plug in framework relates to a stereoscopic Open GL based plugin for Maya.

[0006] US 2004/ 0066555 A1 by Sega Corp relates to a method and an apparatus for generating stereoscopic images that can efficiently generate stereoscopic images that do not burden the observer's eyes are provided.

SUMMARY OF THE INVENTION

[0007] Therefore, it is a primary object of the present

invention to provide a novel display controlling program, a novel display controlling apparatus, a novel display controlling method and a novel display controlling system.

[0008] Another object of the present invention is to provide a display controlling program, a display controlling apparatus, a display controlling method and a display controlling system that are able to automatically switch between a 3D display and a 2D display. The present invention attains the above objective by the independent claims 1, 25, 26 and 27. Preferred embodiments are described in the dependent claims 2 to 24. The reference numerals, step Nos., and the like in parenthesis indicate the correspondence with the embodiment described in order to aid in understanding the present invention. A first aspect is a storage medium storing a display controlling program to be executed by a computer of a display controlling apparatus that makes a display on an autostereoscopic displayable display, wherein the display controlling program causes the computer to function as: a stereoscopic display which makes a stereoscopic display on the display by utilizing a predetermined stereoscopic image; a planar display which makes a planar display on the display by utilizing a predetermined planar image; an input accepter which accepts an input from a predetermined input device; and a display switcher which switches from the display by the stereoscopic display to the display by the planar display in a case that a state that no input is made from the input device to the input accepter continues past a predetermined time period during the display by the stereoscopic display.

[0009] In the first aspect, a display controlling apparatus displays a virtual space on an autostereoscopic displayable display. A stereoscopic display makes a stereoscopic display on the display, and a planar display makes a planar display on the display. An input accepter accepts an input from a predetermined input device. A display switcher switches the display by the stereoscopic display to the display by the planar display in a case that a state that no input is made from the input device to the input accepter continues past a predetermined time period during the display by the stereoscopic display.

[0010] According to the first aspect, in a case there is not input past a predetermined time period during the stereoscopic image display (3D display), it is possible to automatically switch from the stereoscopic image display (3D display) to the planar image display (2D display).

[0011] A second aspect is according to the first aspect, wherein the display controlling apparatus is for displaying a virtual space on the display, the display controlling program causes the computer to further function as: a virtual imager which can image a stereoscopic image for displaying an object in a three-dimensional manner and a planar image for displaying the object in a two-dimensional manner in the virtual space, wherein the stereoscopic display makes a stereoscopic display on the display by utilizing the stereoscopic image imaged by the virtual imager, the planar display makes a planar dis-

play on the display by utilizing the planar image imaged by the virtual imager.

[0012] In the second aspect, a virtual imager images a stereoscopic image for displaying an object in a three-dimensional manner and/or a planar image for displaying the object in a two-dimensional manner in the virtual space. The stereoscopic displayer makes a stereoscopic display by utilizing the stereoscopic image imaged by the virtual imager, and the planar displayer makes a planar display by utilizing the planar image imaged by the virtual imager.

[0013] According to the second aspect, by utilizing the stereoscopic image (3D image) and/or the planar image (2D image) imaged within the virtual space, it is possible to switch the display.

[0014] A third aspect is according to the second aspect, wherein the virtual imager images a left image and a right image by a left virtual camera and a right virtual camera arranged at a predetermined space within the virtual space such that the object is included in an imaging range of the left virtual camera and/or the right virtual camera during the display by the stereoscopic display, and images an image such that the object is included in the imaging range by the predetermined virtual camera within the virtual space when the display by the stereoscopic displayer switches to the display by the planar displayer.

[0015] In the third aspect, during the stereoscopic image display (3D display), a left image and a right image are imaged by a left virtual camera and a right virtual camera arranged at a predetermined space within the virtual space such that the object is included in an imaging range of the left virtual camera and/or the right virtual camera during the display by the stereoscopic displayer. At this time, there is a parallax between the left image and the right image. When the stereoscopic image display (3D display) is switched to the planar image display (2D display), imaging is made such that the object is included in the imaging area by the predetermined virtual camera within the virtual space. There is no parallax in this image.

[0016] According to the third aspect, by switching among the left virtual camera and the right virtual camera, and the predetermined virtual camera, it is possible to easily switch from the stereoscopic image display (3D display) to the planar image display (2D display).

[0017] A fourth aspect is a display controlling program according to the third aspect, wherein the planar displayer displays any one of the left image and the right image that are respectively imaged by the left virtual camera and the right virtual camera.

[0018] In the fourth aspect, the left image and the right image are equal to each other, and therefore, by displaying any one of them as well, it is possible to make a planar image display (2D display).

[0019] A fifth aspect is according to the third aspect, wherein the predetermined virtual camera is positioned midway between the left virtual camera and the right virtual camera.

[0020] According to the fifth aspect, the imaging position of the planar image (2D image) is a midway position between the imaging positions of the stereoscopic image (3D image), and therefore, it is possible to reduce uncomfortable feeling at a time when the display is switched.

[0021] A sixth aspect is according to the third aspect, wherein the virtual imager performs imaging by moving the left virtual camera and the right virtual camera to a common position in response to a switch from the display by the stereoscopic displayer to the display by the planar displayer.

[0022] According to the sixth aspect, by moving the left virtual camera and the right virtual camera to the common position, it is possible to easily switch from the stereoscopic image display (3D display) to the planar image display (2D display).

[0023] A seventh aspect is according to the sixth aspect, wherein the virtual imager images a left image and a right image by the left virtual camera and the right virtual camera spacedly arranged right and left with respect to the object within the virtual space during the display by the stereoscopic displayer.

[0024] In the seventh aspect, during the stereoscopic image display (3D display), a left image and a right image are imaged by the left virtual camera and the right virtual camera spacedly arranged right and left with respect to the object within the virtual space. At this time, there is a parallax between the left image and the right image. When the stereoscopic image display (3D display) is switched to the planar image display (2D display), the left virtual camera and the right virtual camera are moved to the common position to make the prallax between the left image and the right image disappear.

[0025] According to the seventh aspect, by moving the virtual camera, it is possible to easily switch from the stereoscopic image display (3D display) to the planar image display (2D display).

[0026] An eighth aspect is according to the sixth aspect, wherein the planar displayer displays any one of the left image and the right image that are respectively imaged by the left virtual camera and the right virtual camera at the common position.

[0027] In the eighth aspect, the left image and the right image are equal to each other, and therefore, by displaying any one of them, it is possible to make a planar image display (2D display).

[0028] A ninth aspect is according to the sixth aspect, wherein the planar displayer displays the planar image based on both of the left image and the right image that are respectively imaged by the left virtual camera and the right virtual camera at the common position.

[0029] According to the ninth aspect, the left image and the right image are equal to each other, and therefore, on the basis of both of the images, for example, by displaying them to be overlaid with each other, or alternately displaying them on a row-by-row basis, it is possible to make the planar image display (2D display).

[0030] A tenth aspect is according to any one of the sixth to ninth aspects, wherein the common position is a position midway between the positions of the left virtual camera and the right virtual camera during the display by the stereoscopic display.

[0031] According to the tenth aspect, the imaging position of the planar image (2D image) is a midway position between the imaging positions of the stereoscopic image (3D image), and therefore, it is possible to reduce uncomfortable feeling when the display is switched.

[0032] An eleventh aspect is according to the tenth aspect, wherein the virtual imager gradually moves the left virtual camera and the right virtual camera to the midway position.

[0033] In the eleventh aspect, by gradually moving the left virtual camera and the right virtual camera, it is possible to smoothly switch the display.

[0034] Additionally, the virtual imager instantaneously moves the left virtual camera and the right virtual camera to the midway position.

[0035] A twelfth aspect is according to the eleventh aspect, wherein the virtual imager moves the left virtual camera and the right virtual camera toward the midway position at a uniform velocity.

[0036] In the twelfth aspect, by making the moving velocity uniform, it is possible to smoothly switch the display.

[0037] A thirteenth aspect is according to the first aspect, wherein the display switcher further switches from the display by the planar display to the display by the stereoscopic display in a case that there is an input from the input device to the input accepter during the display by the planar display.

[0038] In the thirteenth aspect, if there is an input during the planar image display (2D display), it is possible to automatically switch from the planar image display (2D display) to the stereoscopic image display (3D display).

[0039] A fourteenth aspect is according to the seventh aspect, wherein the virtual imager moves right and left the left virtual camera and the right virtual camera that are placed at the common position with respect to the object in response to a switch from the display by the planar display to the display by the stereoscopic display.

[0040] In the fourteenth aspect, in response to a switch from the planar image display (2D display) to the stereoscopic image display (3D display), the left virtual camera and the right virtual camera are respectively moved left and right, and therefore, parallax occurs between the left image and the right image to change the planar image (2D image) to the stereoscopic image (3D image).

[0041] According to the fourteenth aspect, by moving the virtual camera, it is possible to easily switch from the planar image display (2D display) to the stereoscopic image display (3D display).

[0042] A fifteenth aspect is according to the second aspect, wherein the virtual imager images a stereoscopic image which can display an object in a three-dimensional manner and a planar image which can display the object

in a two-dimensional manner within the virtual space, and the display controlling program causes the computer to further function as an object controller which controls the object within the virtual space in response to an input accepted by the input acceptor.

[0043] In the fifteenth aspect, the object in the virtual space is moved or deformed, and so forth according to an input from the input device.

[0044] According to the fifteenth aspect, the switch between the planar image display (2D display) and the stereoscopic image display (3D display) can be performed in association with an interactive input for controlling an object.

[0045] A sixteenth aspect is according to the fifteenth aspect, wherein the object controller automatically moves the object within the virtual space, and controls, when an input is accepted by the input accepter, the object in response to the input.

[0046] According to the sixteenth aspect, it is possible to perform an interactive virtual game in which in a case that there is no input from the input device, the object is automatically moved, and in a case that there is an input from the input device, the object is moved in correspondence with an input.

[0047] A seventeenth aspect is according to the fifteenth aspect, wherein the input device includes a manually operation input device, and the input accepter includes a manually operation input accepter which accepts a manually operation input from the manually operation input device.

[0048] In the seventeenth aspect, switching the display is made in association with a manually operation input for controlling an object.

[0049] An eighteenth aspect is according to any one of the fifteenth to the seventeenth aspects, wherein the input device includes a sound input device, and the input accepter includes a sound input accepter which accepts a sound input from the sound input device.

[0050] In the eighteenth aspect, switching the display is performed in association with a sound input for controlling an object.

[0051] A nineteenth aspect is according to any one of the fifteenth to eighteenth aspects, wherein the input device includes an image input device, and the input accepter includes an image input accepter which accepts an image input from the image input device.

[0052] In the nineteenth aspect, switching the display is performed in association with an image input for controlling an object.

[0053] A twentieth aspect is according to any one of the fifteenth to nineteenth aspects, wherein the input device includes a motion input device, and the input accepter includes a motion input accepter which accepts a motion input from the motion input device.

[0054] In the twentieth aspect, switching the display is performed in association with a motion input for controlling an object.

[0055] A twenty-first aspect is according to any one of

the seventeenth to twentieth aspects, wherein the display switcher detects a state that there is no input from any of the inputter as the non-input state.

[0056] In the twenty-first aspect, a state that an input including one or plurality of manually operation input, sound input, image input and motion input is not detected is regarded as the non-input state.

[0057] According to the seventeenth to twenty-first aspects, more specifically, switching the display can be performed in a case that an interactive virtual game, etc. in which a manual operation, a speech voice, an orientation of the face, gazing, a gesture, a movement of the apparatus itself are utilized for controlling an object is executed.

[0058] A twenty-second aspect is according to the first aspect, wherein the display controlling apparatus has a manually operation input device, the input accepter includes a manually operation detector which detects a manual operation input by the manually operation inputter, the display switcher regards a state that no manual operation is detected by the manually operation detector as the non-input state.

[0059] In the twenty-second aspect, switching the display is performed in association with a manually operation input. The manually operation input, here, may be an input for an object control, and an input except for it, for example, a command input for starting and stopping. In a certain embodiment, the manually operation input device is a touch panel, various buttons (keys), an analog pad, etc.

[0060] According to the twenty-second aspect, it is possible to switch the display in association with the manually operation input.

[0061] A twenty-third aspect is according to the first aspect, wherein the display controlling apparatus has a sound input device, the input accepter includes a speech voice detector which detects a speech voice from the sound input by the sound inputter, and the display switcher regards a state that no speech voice is detected by the speech voice detector as the non-input state.

[0062] In the twenty-third aspect, switching the display is performed in association with a sound input. The sound input, here, may be an input for an object control, and an input except for it, for example, a command input for starting and stopping.

[0063] According to the twenty-third aspect, it becomes possible to switch the display in association with the sound input.

[0064] A twenty-fourth aspect is according to the twenty-third aspect, wherein the display switcher regards a state that no speech voice larger in level than a threshold value is detected as the non-input state.

[0065] According to the twenty-fourth aspect, it is possible to reduce a malfunction due to a speech voice of a human other than the user.

[0066] A twenty-fifth aspect is according to the first aspect, wherein the display controlling apparatus is provided with an imaging device, the input accepter includes a

face detector which detects a facial image from the imaged image imaged by the imaging device, and the display switcher regards a state that no facial image is detected by the face detector as the non-input state.

[0067] In the twenty-fifth aspect, switching the display is performed in association with an image input. The image input, here, may be an input for an object control, and an input except for it, for example, a command input for starting and stopping.

[0068] According to the twenty-fifth aspect, it becomes possible to switch the display in association with an image input.

[0069] A twenty-sixth aspect is according to the twenty-fifth aspect, wherein the display switcher regards a state that no facial image larger in size than a threshold value is detected as the non-input state.

[0070] According to the twenty-sixth aspect, it is possible to reduce a malfunction due to a face of a human other than the user.

[0071] A twenty-seventh aspect is according to the first aspect, wherein the display controlling apparatus is provided with a motion sensor, the input accepter includes a motion detector which detects a motion of the display controlling apparatus by the motion sensor, and the display switcher regards a state that no motion larger than a threshold value is detected by the motion detector as the non-input state.

[0072] In the twenty-seventh aspect, switching the display is performed in association with the motion input.

[0073] According to the twenty-seventh aspect, it becomes possible to switch the display in association with the motion input.

[0074] A twenty-eighth aspect is according to the first aspect, wherein the display is an autostereoscopic displayable display by a parallax barrier, the display controlling program causes the computer to further function as: a voltage applying controller which applies a voltage to the parallax barrier in a case that a stereoscopic display is performed on the display by the stereoscopic display, and does not apply a voltage to the parallax barrier in a case that a planar display is performed on the display by the planar display.

[0075] In the twenty-eighth aspect, the stereoscopic image display (3D display) is performed by utilizing the parallax barrier. The switch between the stereoscopic image display (3D display) and the planar image display (2D display) is implemented by turning on/off the voltage applied to the parallax barrier.

[0076] It should be noted that in a certain embodiment, the parallax barrier is a barrier liquid crystal, and the LCD controller controls a voltage applied to the barrier liquid crystal to thereby turn the barrier liquid crystal on/off, that is, make it opaque /transparent. The parallax barrier can be made of any materials without being restricted to the liquid crystal if only the materials become opaque/trans-

parent in response to the applied voltage.

[0077] According to the twenty-eighth aspect, by utilizing the parallax barrier, the stereoscopic image display (3D display) can be performed, and when the stereoscopic image display (3D display) switches to the planar image display (2D display), the parallax barrier is turned off (the barrier liquid crystal is made transparent, for example) to thereby extend a suitable viewing position or increase the brightness.

[0078] It should be noted that the stereoscopic image display (3D display), that is, the autostereoscopic display can be implemented by a system other than the parallax barrier, such as a lenticular (sheet with concaves/convexes) system, for example. In addition, the switch from the stereoscopic image display (3D display) to the planar image display (2D display), that is, switching to the planar display can be implemented by a system other than the parallax barrier, such as a lenticular (sheet with concaves/convexes) system. It should be noted that in a case of the lenticular, for example, when the stereoscopic image display (3D display) switches to the planar image display (2D display), it is difficult to extend the suitable viewing position and increase the brightness.

[0079] A twenty-ninth aspect is a display controlling program to be executed by a computer of a display controlling apparatus that makes a display on an autostereoscopic displayable display, wherein the display controlling apparatus is provided with an imaging device, the display controlling program causes the computer to function as: a stereoscopic display which makes a stereoscopic display on the display by utilizing a predetermined stereoscopic image; a planar display which makes a planar display on the display by utilizing a predetermined planar image; a face detector which detects a facial image from an imaged image imaged by the imaging device; and a display switcher which switches from the display by the stereoscopic display to the display by the planar display in a case that a state no facial image is detected by the face detector continues past a predetermined time period during the display by the stereoscopic display.

[0080] According to the twenty-ninth aspect, in a case that no facial image is detected past the predetermined time period during the stereoscopic image display (3D display), the stereoscopic image display (3D display) can be automatically switched to the planar image display (2D display).

[0081] A thirtieth aspect is a display controlling apparatus making a display on an autostereoscopic displayable display, wherein a stereoscopic display which makes a stereoscopic display on the display by utilizing a predetermined stereoscopic image; a planar display which makes a planar display on the display by utilizing a predetermined planar image; an input accepter which accepts an input from a predetermined input device; and a display switcher which switches from the display by the stereoscopic display to the display by the planar display in a case that a state that no input is made from the input device to the input accepter continues past a

predetermined time period during the display by the stereoscopic display.

[0082] A thirty-first aspect is a display controlling method by a display controlling apparatus making a display on an autostereoscopic displayable display, including following steps of: a stereoscopic displaying step for making a stereoscopic display on the display by utilizing a predetermined stereoscopic image; a planar displaying step for making a planar display on the display by utilizing a predetermined planar image; an input accepting step for accepting an input from a predetermined input device; and a display switching step for switching from the display by the stereoscopic displaying step to the display by the planar displaying step in a case that a non-input state from the input device to the input accepting step continues past a predetermined time period during the display by the stereoscopic displaying step.

[0083] A thirty-second aspect is a display controlling system making a display on an autostereoscopic displayable display, wherein a stereoscopic display which makes a stereoscopic display on the display by utilizing a predetermined stereoscopic image; a planar display which makes a planar display on the display by utilizing a predetermined planar image; an input accepter which accepts an input from a predetermined input device; and a display switcher which switches from the display by the stereoscopic display to the display by the planar display in a case that a state that no input is made from the input device to the input accepter continues past a predetermined time period during the display by the stereoscopic display.

[0084] In each of the thirtieth to thirty-second aspects as well, similar to the first aspect, in a case there is not input past a predetermined time period during the stereoscopic image display (3D display), it is possible to automatically switch from the stereoscopic image display (3D display) to the planar image display (2D display).

[0085] A thirty-third aspect is a display controlling apparatus making a display on an autostereoscopic displayable display, comprising: an imaging device; a stereoscopic display which makes a stereoscopic display on the display by utilizing a predetermined stereoscopic image; a planar display which makes a planar display on the display by utilizing a predetermined planar image; a face detector which detects a facial image from an imaged image imaged by the imaging device; and a display switcher which switches from the display by the stereoscopic display to the display by the planar display in a case that a state that no facial image is detected by the face detector continues past predetermined time period during the display by the stereoscopic display.

[0086] A thirty-fourth aspect is a display controlling method by a display controlling apparatus making a display on an autostereoscopic displayable display, wherein the display controlling apparatus is provided with an imaging device; including following steps of: a stereoscopic displaying step for making a stereoscopic display on the display by utilizing a predetermined stereoscopic image;

a planar displaying step for making a planar display on the display by utilizing a predetermined planar image; a face detecting step for detecting a facial image from an imaged image imaged by the imaging device; and a display switching step which switches from the display by the stereoscopic displaying step to the display by the planar displaying step in a case that a state that no facial image is detected by the face detecting step continues past a predetermined time period during the display by the stereoscopic displaying step.

[0087] A thirty-fifth aspect is display controlling system making a display on an autostereoscopic displayable display, comprising: an imaging device; a stereoscopic display which makes a stereoscopic display on the display by utilizing a predetermined stereoscopic image; a planar display which makes a planar display on the display by utilizing a predetermined planar image; a face detector which detects a facial image from an imaged image imaged by the imaging device; and a display switcher which switches from the display by the stereoscopic display to the display by the planar display in a case that a state that no facial image is detected by the face detector continues past a predetermined time period during the display by the stereoscopic display.

[0088] In each of the thirty-third to thirty-fifth aspects, similar to the twenty-ninth aspect, in a case that no facial image is detected past the predetermined time period during the stereoscopic image display (3D display), the stereoscopic image display (3D display) can be automatically switched to the planar image display (2D display).

[0089] According to the present invention, it is possible to automatically switch between the stereoscopic image display (3D display) and the planar image display (2D display). This saves the user from having to make a switch, capable of enhancing customer convenience.

[0090] The above described objects and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0091]

Figure 1 is an external view of a game apparatus of one embodiment of the present invention, and shows a top surface in an open state;

Figure 2 is an external view of the game apparatus, Figure 2 (A) shows a top surface in a close state, Figure 2 (B) shows a left side surface in the close state, Figure 2(C) is a front surface in the close state, Figure 2 (D) is a right side surface in the close state, Figure 2 (E) shows a back surface in the close state, and Figure 2(F) shows a bottom surface in the closed state;

Figure 3 is an illustrative view for explaining an operation of a 3D adjusting switch;

Figure 4 is a block diagram showing one example of an electric configuration of the game apparatus; Figure 5 is a block diagram showing a main part (stereoscopic LCD controller being formed of a stereoscopic LCD and a part of SOC) of the electric configuration in Figure 4;

Figure 6 is an illustrative view for explaining a principle of a 3D/2D display in a parallax barrier system, Figure 6(A) shows a state that a parallax barrier is turned on (3D display), and Figure 6(B) shows a state that a parallax barrier is turned off (2D display);

Figure 7 is an illustrative view showing a situation in which an object is imaged by right and left two virtual cameras in a virtual space;

Figure 8 is an illustrative view showing an imaged image (the distance-between cameras is a maximum value D0) by the two virtual cameras, Figure 8(A) shows a left image of a VRAM, Figure 8(B) shows a right image of the VRAM, and Figure 8(C) shows a stereoscopic image (3D up to maximum of) on an upper LCD;

Figure 9 is an illustrative view explaining a change of a stereoscopic image according to a distance-between cameras, Figure 9(A) shows one example of the distance-between cameras ($0.5 \times D0$), and Figure 9(B) shows a stereoscopic image corresponding to the relevant distance (3D is middle);

Figure 10 is an illustrative view explaining a 3D adjustment according to the distance-between cameras, Figure 10(A) shows another example of the distance-between cameras (minimum value 0), and Figure 10(B) shows a stereoscopic image corresponding to the relevant distance (3D is minimum=2D);

Figure 11 is an illustrative view showing a part of a memory map of a main memory;

Figure 12 is a flowchart showing a part of an operation by a CPU;

Figure 13 is a flowchart showing another part of the operation by the CPU;

Figure 14 is a flowchart showing a still another part of the operation by the CPU;

Figure 15 is a flowchart showing a further part of the operation by the CPU;

Figure 16 is a flowchart showing another part of the operation by the CPU; and

Figure 17 is a flowchart showing a still another part of the operation by the CPU.

50 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0092] In Figure 1 and Figure 2, an appearance of a game apparatus 10 of one embodiment of the present invention is shown. The game apparatus 10 is a foldable game apparatus, Figure 1 shows a top view of the game apparatus 10 in an open state, Figure 2 (A) to Figure 2 (F) respectively shows a top surface, a left side surface,

a front surface, a right side surface, a back surface and a bottom surface of the game apparatus 10 in a closed state.

[0093] The game apparatus 10 has an upper housing 10A and a lower housing 10B rotatably connected with each other as shown in Figure 1, and on a top surface of the upper housing 10A, a stereoscopic LCD 12 compliant with an autostereoscopic display, an inward camera 18a, a 3D adjusting switch 20, a 3D lamp 20A, right and left speakers 22a and 22b, etc. are provided. On a top surface of the lower housing 10B, a lower LCD 14 attached with touch panel 16, A, B, X, Y buttons 24a-24d, a cross key (button) 24g, home, select, start buttons 24h-24j, a power button 24k, an analog pad 26, and a microphone 30 are provided.

[0094] Furthermore, as shown in Figure 2 (A), on a top surface of the game apparatus 10 (reverse side of the upper housing 10A shown in Figure 1) in the closed state, right and left outward cameras 18b and 18c compliant with 3D imaging are provided. Furthermore, as shown in Figure 2 (C), on a front surface of the game apparatus 10, a headphone terminal 36, a power lamp 42a, etc. are provided. Also, as shown in Figure 2 (B), Figure 2 (E) and Figure 2 (D), from a left side surface to a back surface of the game apparatus 10, an L button 24e is provided, and from a right side surface to a back surface, an R button 24f is provided. Moreover, on the left side surface of the game apparatus 10, a volume control switch 32, an SD card slot 34, etc. are provided, and on the right side surface of the game apparatus 10, a wireless switch 28, a wireless lamp 42b, etc. are provided. The above-described 3D adjusting switch is exposed from the right side surface. In addition, on the back surface of the game apparatus 10, an infrared ray emitting-receiving portion 40, etc. is provided. Then, as shown in Figure 2 (E) and Figure 2 (F), from the back surface to a bottom surface, a game card slot 38 is provided.

[0095] The stereoscopic LCD 12 is a 3D liquid crystal (see Figure 6) according to a parallax barrier system, and displays a stereoscopic image without any glasses (auto-stereoscopic image). On the stereoscopic LCD 12, by turning a parallax barrier of the liquid crystal off, a planar image display is also made possible. It should be noted that a lenticular system utilizing a sheet with concaves/convexes (lenticular lens) and other autostereoscopic 3D systems may be adopted without being restricted to the parallax barrier system.

[0096] The inward camera 18a images a planar image (2D image) while the outward cameras 18b and 18c image stereoscopic images (3D image). A 2D or 3D image imaging the player can be used as an image input to a game program (72: described later). In this case, the game program 72 detects movements of a face, a hand and a gazing direction (direction of eyeballs) of the player by performing image recognition, and executes processing corresponding to the detection result. The 2D image by the inward camera 18a can be displayed on the lower LCD 14, and the 3D images by the outward cameras 18b

and 18c can be displayed on the stereoscopic LCD 12.

[0097] The 3D adjusting switch 20 manually switches the display of the stereoscopic LCD 12 between the 3D display and the 2D display, and is a slide switch for manually adjusting a three-dimensional effect in the 3D display as well and operates as shown in Figure 3, for example. The three-dimensional effect of the 3D display becomes a maximum ($S_d=1$) when the slider S_d is at an upper end, decrease as the slider S_d is moved down, and becomes a minimum ($S_d=0$) when at a lower end in this embodiment. Then, the 3D display changes to the 2D display when the slider S_d is moved down.

[0098] Although the detailed description is made later, such a change of the three-dimensional effect of the 3D display is implemented by changing the distance (distance-between cameras D) between the right and left virtual cameras (ICL and ICR: see Figure 7) arranged within the virtual space (see Figure 7-Figure 10). That is, according to an operation of the 3D adjusting switch 20, the distance-between cameras D is adjusted. Then, the distance-between cameras D receives an automatic adjustment (described later) by the game program 72 as well as the manual adjustment.

[0099] The 3D lamp 20A is a lamp showing a displaying condition of the stereoscopic LCD 12, and lights up in the 3D display and light off in the 2D display. Here, it may be changed in brightness and color in correspondence with the degree of the 3D display (intensity of the three-dimensional effect) as well as it merely lights up and off.

[0100] An operation to the touch panel 16, the A, B, X, Y buttons 24a-24d, the cross key (button) 24g, the home, select, start buttons 24h-24j, or the analog pad 26 is used as a touch/button/pad input to the game program 72. The power button 24k is used for turning on or off the power of the game apparatus 10. The power lamp 42a lights up or off in conjunction with the power-on or the power-off of the power source.

[0101] The microphone 30 converts a user speech voice, an environmental sound, etc. to sound data. The sound data can be used as a sound input to the game program 72. In this case, the game program 72 detects the speech voice by the player by performing voice recognition, and executes processing according to the detection result. The sound data by the microphone 30 can be further recorded in a NAND-type flash memory 48 (see Figure 4), etc.

[0102] The speakers 22a and 22b output a game voice, a microphone voice, etc. To the headphone terminal 36, a headphone not shown is connected. The volume control switch 32 is a slide switch for adjusting volumes of the speakers 22a and 22b or an output from the headphone terminal 36.

[0103] The SD card slot 34 is attached with an SD memory card (not illustrated) for storing a camera image, a microphone sound, etc., and the game card slot 38 is attached with a game card (not illustrated) storing the game program 72, etc. The infrared ray emitting-receiving portion 40 is utilized for infrared rays (IR) communi-

cations with another game apparatus.

[0104] Figure 4 shows an electric configuration of the game apparatus 10. The game apparatus 10 includes an SoC (System-on-a-Chip) 44 being made up of a CPU, a GPU, a VRAM, a DSP, etc. The SoC 44 is connected with the above-described stereoscopic LCD 12, lower LCD 14, inward camera (In camera) 18a, right and left outward cameras (OCAM-L and OCAM-R) 18b and 18c, A, B, X, Y, L, R buttons 24a-24f, cross button 24g, SD card slot 34, game card slot 38, and infrared ray emitting-receiving portion (IR) 40. The SoC 44 is further connected with the above-described 3D adjusting switch (3D Vol) 20, 3D lamp 20A, home, select, start buttons 24h-24j, power button (Power) 24k, wireless switch (WiFi) 28, volume control switch (volume Vol) 32, and power, wireless lamps 42a, 42b via a microcomputer (hereinafter referred to as "micon") 56. The SoC 44 is moreover connected with the above-described touch panel 16, right and left speakers 22a and 22b, analog pad 26, microphone (Mic) 30 and headphone terminal 36 via an IF circuit 58.

[0105] In addition, the SoC 44 is connected with a wireless module 46, the NAND-type flash memory 48 and a main memory 50 as elements other than the above description. The wireless module 46 has a function of connecting to a wireless LAN. The NAND-type flash memory 48 stores data for saved, such as a camera image, a microphone voice, etc. The main memory 50 gives a working area to the SoC 44. That is, in the main memory 50, various data and programs to be used in the game are stored, and the SoC 44 performs works by utilizing the data and program stored in the main memory 50.

[0106] The micon 56 is connected with a power source management IC 52 and an acceleration sensor 54. The power source management IC 52 performs a power source management of the game apparatus 10, and the acceleration sensor 54 detects accelerations in the three-axis directions of the game apparatus 10. The detection result of the acceleration sensor 54 can be used as a motion input to the game program 72. In this case, the game program 72 calculates a motion of the game apparatus 10 itself on the basis of the detection result, and executes processing according to the calculation result. Furthermore, the micon 56 includes an RTC (real-time clock) 56a, and counts a time by the RTC 56a to supply the same to the SoC 44.

[0107] Figure 5 shows a stereoscopic LCD controller 12A being made up of the stereoscopic LCD 12 and a part of the SOc44. The stereoscopic LCD 12 includes an LCD controller 12a, a barrier liquid crystal 12b and an upper LCD 12c. The barrier liquid crystal 12b includes a plurality of liquid crystal slits extending in a vertical (row) direction as shown in Figure 6(A), and makes the right eye and the left eye view beams passing through pixels in a different row of the upper LCD 12c by alternately cutting off the beam from the backlight by the plurality of liquid crystal slits. The upper LCD 12c may be a general liquid crystal (for 2D display) similar to the lower LCD 14. The LCD controller 12a performs drawing on the upper

LCD 12c under the control of the GPU 44b and then the CPU 44a, and turns the barrier liquid crystal 12b (applied voltage) on and off. When the barrier liquid crystal 12b is turned off, the right eye and the left eye can view the beams passing through the pixels of all the rows on the upper LCD 12c as shown in Figure 6(B).

[0108] More specifically, as shown in Figure 7, in a case that objects Ob1 and Ob2 are imaged by a left virtual camera ICL and a right virtual camera ICR spacedly arranged right and left ($D=D_0$) within the virtual space, the GPU 44b writes a left image 44L and a right image 44R as shown in Figure 8(A) and Figure 8(B) to the VRAM 44c, and the LCD controller 12a alternately reads the left image 44L and the right image 44R stored in the VRAM 44c on a row-by-row basis, and draws them in the upper LCD 12c in order under the control of the CPU 44a. Thus, on the upper LCD 12c, a stereoscopic image (for implementing a stereoscopic views) as shown in Figure 8(C) is displayed. When a backlight beam to the stereoscopic image is limited by the barrier liquid crystal 12b, the left eye can view the left image 44L as shown in Figure 8(A), and the right eye can view the right image 44R as shown in Figure 8(B), so that autostereoscopy is implemented.

[0109] By the way, as described above, the stereoscopic image in Figure 8(C) is an image when the distance-between cameras D becomes the maximum ($D=D_0$: see Figure 7), and it changes from Figure 9(B) to Figure 10(B) as the distance-between cameras D is shorter from Figure 9(A) to Figure 10(A). The distance-between cameras D is calculated according to the following equation (1).

$$D=S_d \times P_d \times D_0 \dots (1)$$

[0110] Here, S_d is a variable showing a value of the slider S_d of the 3D adjusting switch 20 shown in Figure 3, and changes within a range from 0 to 1 in accordance with an operation of the slider S_d ($0 \leq S_d \leq 1$). P_d is a variable to be controlled by the game program 72, and similarly changes within a range from 0 to 1 ($0 \leq P_d \leq 1$). D_0 is a constant corresponding to a space between the two pupils of the human, and is set to 65 mm, for example ($D_0=65\text{mm}$).

[0111] In each of Figure 7, Figure 9(A) and Figure 10(A), the variable S_d is 1, and the slider S_d is fixed at the upper end ($S_d=1$). The variable P_d changes as in $1 \rightarrow 0.5 \rightarrow 0$ by the game program 72, so that the distance-between cameras D changes as in $D_0 \rightarrow (0.5 \times D_0) \rightarrow 0$. Then, in correspondence with the change in a direction in which the distance-between cameras D is decreased, the stereoscopic image changes as in Figure 8(C) \rightarrow Figure 9(B) \rightarrow Figure 10(B). That is, the parallax between the left image 44L and the right image 44R decreases, and becomes equal to the planar image.

[0112] Here, if the variable S_d is fixed at 0.5 ($S_d=0.5$), the distance-between cameras D changes within the

range from 0 to $(0.5 \times D_0)$. Furthermore, if the variable S_d is fixed at 0 ($S_d=0$), the distance-between cameras D remains 0.

[0113] In a case of a state in Figure 10(A), that is, in a case of the minimum of the 3D display or in a case of the 2D display, the distance-between cameras D becomes 0, so that the left image 44L and the right image 44R which are written to the VRAM 44c become the same (that is, the parallax is 0). In this case as well, the LCD controller 12a alternately reads the left image 44L and the right image 44R stored in the VRAM 44c on a row-by-row basis, and draws them in the upper LCD 12c in order. Thus, a planar image (that is, image without parallax) as shown in Figure 10(B) is displayed on the upper LCD 12c. When the barrier liquid crystal 12b for restricting the backlight to the stereoscopic image is turned off, the right and left eyes can view the planar image shown in Figure 10(B).

[0114] Here, even if the barrier liquid crystal 12b is not turned off at this time, the planar image shown in Figure 10(B) can still be viewed. It should be noted that when the barrier liquid crystal 12b is turned off, a suitable viewing position is extended to make the planar image appear bright. Furthermore, the LCD controller 12a may read only one of the left image 44L and the right image 44R in place of alternately reading them to draw it in the upper LCD 12c. In this case as well, the planar image as shown in Figure 10(B) is displayed on the upper LCD 12c.

[0115] The aforementioned operation is implemented by executing the processing shown in Figure 12 to Figure 17 on the basis of the program and data shown in Figure 11 stored in the main memory 50 by the CPU 44a making up of the stereoscopic LCD controller 12A in conjunction with the GPU 44b and the LCD controller 12a.

[0116] Referring to Figure 11, the main memory 50 is formed with a program area 70 and a data area 80, and in the program area 70, the game program 72 is stored. The game program 72 includes a sound recognition program 72a, an image recognition program 72b, etc. In the data area 80, an input information area 82, an input flag area 84, a timer area 86, a distance-between cameras area 88, a mode area 90, etc. are formed. In the data area 80, a database (DB) 92 to be referred by the game program 72 is also stored. The database 92 includes a sound input DB which stores speech voices of a specific or an average player in association with commands and an image input DB which stores a facial images of a specific or an average player and further stores an orientation of the facial image and a movement of the eyeballs (gazing line), a movement of the lip, etc. included in the facial image in association with commands. Here, the image input DB may include data in relation to the hands (gesture), for example, other than the face (including the eyes, the lip, etc.).

[0117] The game program 72 is a main software program for executing processing according to flowcharts shown in Figure 13-Figure 16 by controlling various pieces of hardware (12 to 58) via the CPU 44a. The sound

recognition program 72a and the image recognition program 72b are sub software programs to be used by the game program 72 in the course of such processing. The sound recognition program 72a recognizes a speech voice by the player by performing sound recognizing processing based on the sound input DB on the sound data input through the microphone 30. The recognition result is written to the input information area 82 as sound input information. The image recognition program 72b

5 recognizes the face of the player by performing image recognition processing based on the image input DB on the image data input through the cameras 18a-18c, and further determines an orientation of the facial image and a movement of the eyeballs (gazing direction), a movement 10 of the lip (speech operation), a movement of the hands (gesture), etc. The result of the recognition or determination is written to the input information area 82 as image input information.

[0118] In addition, to the input information area 82, 20 touch/ button/pad input information based on an operation by the touch panel 16, the various buttons (keys) 24a-24k or the analog pad 26, and motion input information based on the detection result by the acceleration sensor 54 other than the aforementioned sound input information and image input information are further written.

[0119] The input flag area 84 stores an input flag set or reset according to the game program 72. The input flag includes a sound input flag corresponding to sound input information, an image input flag corresponding to image input information, a touch/button/pad input flag corresponding to touch/button/pad input information, and a motion input flag corresponding to motion input information.

[0120] The timer area 86 stores a value of a timer (period of duration of a non-input state T) reset or incremented by the game program 72. The distance-between cameras memory area 88 stores the distance (distance-between cameras $D=S_d \times P_d \times D_0$) between the right and left virtual cameras ICL and ICR to be controlled by the game program 72. The mode area 90 stores mode information to be controlled by the game program 72. The mode information changes among a mode 1 corresponding to a stereoscopy-on state, a mode 2 corresponding 40 to a transition state from the stereoscopy-on state to a stereoscopy-off state, a mode 3 corresponding to the stereoscopy-off state, and a mode 4 corresponding to a transition state from the stereoscopy-off state to the stereoscopy-on state.

[0121] Referring to Figure 12, when the game program 72 is activated, the CPU 44a performs an initial setting in a step S1. More specifically, "T=0" is written to the timer area 86 to reset the timer, "1" is written to the mode area 90 to set the mode information to the mode 1, "D=Sd×1×D0" is written to the distance-between cameras memory area 88 to set the distance between the right and left virtual cameras ICL and ICR to the maximum, the barrier liquid crystal 12b is turned on via the

LCD controller 12a, the 3D lamp 20A is turned on via the micon 56, and each of the input flags of the input flag area 84 is reset.

[0122] It should be noted that in the variable Sd, a current value of the slider Sd (see Figure 3) is written. The constant D0 is 65 mm, for example. Accordingly, in a case that the position of the slider of the 3D adjusting switch 20 is at the upper end, the distance-between cameras D becomes "1×1×65", that is, 65mm (see Figure 7). Alternatively, in a case that the position of the slider is at the 3D minimum or at the lower end (2D), the distance-between cameras D is "0×1×65", that is, 0. In what follows, an explanation is made with the slider Sd at the upper end (Sd=1).

[0123] Next, the CPU 44a instructs the GPU 44b and the LCD controller 12a to draw an initial stereoscopic image as to the objects Ob1 and Ob2 shown in Figure 7, for example. In response thereto, the GPU 44b writes the left image 44L and the right image 44R (Figure 8(A) and Figure 8(B)) by the virtual cameras ICL and ICR (D=D0) as shown in Figure 7 to the VRAM 44c (see Figure 5). The LCD controller 12a alternately reads the left image 44L and the right image 44R stored in the VRAM 44c on a row-by-row basis, and draws them in the upper LCD 12c in order. Thus, on the upper LCD 12c, the stereoscopic image as shown in Figure 8(C) is displayed. The backlight beam to the stereoscopic image is restricted by the barrier liquid crystal 12b (see Figure 6(A)), so that the left eye can view the left image 44L as shown in Figure 8(A) and the right eye can view the right image 44R as shown in Figure 8(B), capable of implementing autostereoscopy.

[0124] Then, the CPU 44a executes loop processing in steps S5 to S17 every frame until the game is ended. In the step S5, input processing is executed (see Figure 13:described later), in the step S7, an input determination is performed, and the determination result is reflected on the input flag (see Figure 14: described later). In the step S9, with reference to the input flag, a stereoscopic mode control is performed (Figure 15-see Figure 17: described later). In the step S11, game processing (processing of moving the object Obj1 and deforming the object Obj2 within the virtual space, for example) based on an input and/or an automatic control is executed. Accordingly, the game can be advanced without any input.

[0125] In the step S12, it is determined whether or not the mode information of the mode area 90 is the "mode 3", and if "NO", a stereoscopic image is drawn in the step S13a, and then, the process proceeds to the step S15. It should be noted that the drawing processing itself in the step S13a is similar to that of the above-described step S3, but through the mode control in the step S9, the distance-between cameras D changes from Figure 9(A) to Figure 10(A), for example, so that the stereoscopic image of the upper LCD 12c changes from Figure 9(B) to Figure 10(B), for example. Furthermore, if the objects Ob1, Ob2 change within the virtual space (moved or deformed, for example) as a result of the game processing

executed in the step S11, the change is reflected on the stereoscopic image of the upper LCD 12c.

[0126] If "NO" in the step S12, the process shifts to the step S13b to draw a planar image, and then, the process proceeds to the step S15. Here, the drawing processing itself in the step S13b is approximately the same as that in the above-described step S3 or S13a. That is, the LCD controller 12a alternately reads the left image 44L and the right image 44R stored in the VRAM 44c on a row-by-row basis, and draws them on the upper LCD 12c in order, but the left image 44L and the right image 44 are the same, and therefore, on the upper LCD 12c, the planar image as shown in Figure 10(B) is displayed. Furthermore, since the barrier liquid crystal 12b is in an off state (S71: described later), both of the eyes can view all the rows of the planar image. However, assuming that the barrier liquid crystal 12b is kept on, the left eye can view the planar image of the odd rows, and the right eye can view the planar image of the even rows, for example, and therefore, visibility does not change (feels dark).

[0127] In the step S15, the input flag is reset, and it is determined whether or not the game is to be ended in the step S17. If "NO" here, the process returns to the step S5 to repeat processing similar to the above description. When an end operation is performed via the touch panel 16, etc., "YES" is determined in the step S17, and the processing is ended.

[0128] The input processing in the aforementioned step S5 is executed according to a subroutine in Figure 13, for example. In a step S21, an input operation by the touch panel 16, various buttons (keys) 24a-24k, or the analog pad 26 is detected, and the touch/ button/pad input information indicating the detection result is written to the input information area 82 together with a time stamp based on an output from the RTC 56a.

[0129] In a step S23, sound recognizing processing based on the sound input DB is performed on the sound data input through the microphone 30 to thereby confirm a speech voice of the player, and the sound input information indicating the recognition result is written together with a time stamp based on an output from the RTC 56a in the input information area 82. Here, even when the speech voice is recognized, if the level of the speech voice is equal to or less than a threshold value, regarding it as a speech voice of others different from the player (or there is nobody irrespective of whoever the person is), writing of the sound input information may not be performed.

[0130] In a step S25, image recognition processing based on the image input DB is performed on the image data input through the cameras 18a-18c to thereby recognize the face of the player and to moreover determine the orientation of the face and the direction of the eyeballs (gazing), and the image input information indicating these recognition and determination results is written to the input information area 82 together with the time stamp based on an output from the RTC 56a. Here, even if the facial image is recognized, if the size of the facial image

(vertical and horizontal lengths, area, etc.) is equal to or less than a threshold value, regarding it as a face of others different from the player (or there is nobody irrespective of whoever the person is), and writing of the image input information may not be performed.

[0131] In a step S27, a movement of the game apparatus 10 itself is detected on the basis of the detection result by the acceleration sensor 54, and the motion input information indicating the detection result is written to the input information area 82 together with the time stamp based on an output from the RTC 56a. Thereafter, the process is restored to the main routine (see Figure 12).

[0132] The input determination in the aforementioned step S7 is executed according to a subroutine in Figure 14, for example. In the subroutine, the CPU 44a determines whether or not there is an input to the game program 72 in this frame with reference to the aforementioned input information attached with time stamp of the input information area 82, and reflects the determination result on the input flag of the input flag area 84. More specifically, in a step S31, a presence or absence of a touch/button/pad input is first determined, and if "NO" here (absences of a relevant input), the process proceeds to a step S35. If "YES" in the step S31 (presence of a relevant input), the touch/button/pad input flag is set in a step S33, and the process proceeds to the step S35.

[0133] In the step S35, it is determined whether or not there is a sound input, and if "NO" here, the process proceeds to a step S39. If "YES" in the step S35, the sound input flag is set in a step S37, and then, the process proceeds to the step S39. In the step S39, it is determined whether or not there is an image input, and if "NO" here, the process proceeds to a step S43. If "YES" in the step S39, the image input flag is set in a step S41, and then, the process proceeds to the step S43. In the step S43, it is determined whether or not there is a motion input, and if "NO" here, the process is restored to the main routine. If "YES" in the step S43, the motion input flag is set in a step S45, and then, the process is restored to the main routine.

[0134] The stereoscopic mode control in the aforementioned step S9 is executed according to a subroutine in Figure 15-Figure 17, for example. Referring first to Figure 15, in a step S51, it is determined whether or not the current stereoscopic mode is the mode 1 with reference to the mode information of the mode area 90, and if "NO" here, the process shifts to a step S63 (see Figure 16). Here, directly after activation, the mode 1 is set in the step S1, and therefore, the determination result in the step S1 becomes "YES". If "YES" in the step S51, the timer (T) of the timer area 86 is incremented (for example $T=T+(1/60)$ seconds) in a step S53, and then, the process proceeds to a step S55.

[0135] In the step S55, it is determined whether or not there is an input to the game program 72 with reference to the input flag of the input flag area 84 (specifically, four kinds of the touch/button/pad input flags, the sound input flag, the image input flag, and the motion input flag). If

no input flag is set, "NO" is determined, and the process proceeds to a step S57. If any kind of the input flags is set, "YES" is determined, and the process shifts to a step S59.

[0136] In the step S57, it is determined whether or not the timer of the timer area 86 is above a threshold value (4 minutes, for example), and if "NO" here ($T \leq 4$ minutes), the process is restored to the main routine (see Figure 12). If "YES" ($T > 4$ minutes) in the step S57, the process shifts to a step S61.

[0137] In the step S59, the timer of the timer area 86 is reset ($T=0$), and then, the process is restored to the main routine. In the step S61, the mode information of the mode area 90 is updated from the mode 1 to the mode 2, and then, the process is restored to the main routine.

[0138] Referring to Figure 16, in the step S63, it is determined whether or not the current stereoscopic mode is the mode 2 with reference to the mode information of the mode area 90, and if "NO" here, the process shifts to a step S79 (see Figure 17). If "YES" in the step S63, by changing the distance-between cameras D stored in the distance-between cameras area 88 only by one step (1/4mm, for example) in a direction in which the distance is decreased, the right and left virtual cameras ICL and ICR are moved to be close to each other in a step S65. In a case that the 1 step is 1/4mm, a time required for changing the distance-between cameras D from 65mm (see Figure 7) to 0 (see Figure 10(A)) becomes about 4 seconds regarding one fame period as 1/60 seconds. Thereafter, the process proceeds to a step S67.

[0139] In the step S67, it is determined whether or not there is an input to the game program 72 with reference to the input flag of the input flag area 84. Here, if no input flag is also set similar to the step S55, "NO" is determined in the step S67, and the process proceeds to a step S69. If even one kind of input flag is set, "YES" is determined in the step S67, and the process shifts to a step S77.

[0140] In the step S69, it is determined whether or not the distance-between cameras D is the minimum. If $D=0$ ($D \leq 0$ under certain circumstances), "YES" is determined, and the process proceeds to a step S71. On the other hand, if $D > 0$, "NO" is determined, and the process is restored to the main routine.

[0141] In the step S71, the barrier liquid crystal 12b (voltage application thereto) is turned off via the LCD controller 12a. In a next step S73, the 3D lamp 20A is turned off via the micon 56. Then, in a step S75, the mode information of the mode area 90 is updated from the mode 2 to the mode 3, and then, the process is restored to the main routine.

[0142] In the step S77, the mode information is updated from the mode 2 to the mode 4, and then, the process is restored to the main routine.

[0143] Referring to Figure 17, in the step S79, it is determined whether or not the current stereoscopic mode is the mode 3 with reference to the mode information of the mode area 90, and if "NO" here, the process shifts

to a step S89 (described later), regarding the current stereoscopic mode as a mode 4. If "YES" in the step S79, the process proceeds to a step S81.

[0144] In the step S81, it is determined whether or not there is an input to the game program 72 with reference to the input flag of the input flag area 84 as described above, and if "NO" here, the process is restored to the main routine. On the other hand, if "YES" in the step S81, the process proceeds to a step S83. In the step S83, the barrier liquid crystal 12b (voltage application thereto) is turned on via the LCD controller 12a. In a next step S85, the 3D lamp is turned on via the micon 56. Then, in a step S87, the mode information of the mode area 90 is updated from the mode 3 to the mode 4, and then, the process is restored to the main routine.

[0145] In the step S89, by changing the distance-between cameras D stored in the distance-between cameras area 88 only by one step (1/4mm, for example) in a direction in which the distance is increased, the right and left virtual cameras ICL and ICR are moved to be away from each other. In a next step S91, it is determined whether or not the distance-between cameras D is the maximum. If $D=S_d \times 1 \times D_0$ ($D \geq S_d \times 1 \times D_0$ under certain circumstances), "YES" is determined, and the process proceeds to a step S93. On the other hand, if $D < S_d \times 1 \times D_0$, "NO" is determined, and the process is restored to the main routine.

[0146] In the step S93, the timer of the timer area 86 is reset ($T=0$). In a next step S95, the mode information of the mode area 90 is updated from the mode 4 to the mode 1, and the process is restored to the main routine.

[0147] Accordingly, the stereoscopic mode of the stereoscopic LCD 12 is the mode 1 at first, that is, the stereoscopy-on state, and the timer is incremented every frame by repetitively performing the step S53. The timer is reset when any input is detected at this frame, and restarts incrementing at the next frame. If a predetermined time, for example, four minutes elapses without any input, the mode 1 changes to the mode 2, that is, the transition state from the stereoscopy-on state to the stereoscopy-off state.

[0148] In the mode 2, by repetitively performing the step S65, the right and left virtual cameras ICL and ICR approach every frame (Figure 7→Figure 9(A)), and when both of them arrive at the same position (unified: Figure 10(A)), the mode 2 changes to the mode 3, that is, the stereoscopy-off state. Here, if an input is detected before the virtual cameras ICL and ICR arrive at the same position, the mode 2 changes to the mode 4, that is, the transition state from the stereoscopy-off state to the stereoscopy-on state.

[0149] When an input is detected in the mode 3, the mode 3 changes to the mode 4, that is, the transition state from the stereoscopy-off state to the stereoscopy-on state. In the mode 4, when by repetitively performing the step S89, the right and left virtual cameras ICL and ICR are far away from each other every frame (Figure 10(A)→Figure 9(A)), and both of them return to the initial

position (space becomes the maximum: Figure 7), and the mode 4 changes to the mode 1, that is, the stereoscopy-on state.

[0150] Here, the timer (T) is stopped in the modes 2 and 3, and reset at a time when the right and left virtual cameras ICL and ICR are returned to the initial position in the mode 4.

[0151] Furthermore, the barrier liquid crystal 12b and the 3D lamp 20A are turned on through the modes 1 and 2, are turned off at a timing when the mode 2 changes to the mode 3, are kept off in the mode 3, and are turned on at a timing when the mode 3 changes to the mode 4. It should be noted that the 3D lamp 20A is not necessarily cooperated with the barrier liquid crystal 12b, and may be displayed when the 3D display is made possible, for example. In this case, the 3D lamp 20A lights up even during the 2D display when the 3D display is made possible.

[0152] Here, the aforementioned determinations in the steps S69 and S91 may be performed on the variable Pd. More specifically, in the step S69, if $Pd=0$ ($Pd \geq 1$ under certain circumstances), "YES" is determined, and the process proceeds to the step S71. On the other hand, if $Pd < 1$, "NO" is determined, and the process is restored to the main routine. Similarly, in the step S91, if $Pd=1$ ($Pd \geq 1$ under certain circumstances), "YES" is determined, and the process proceeds to a step S93. On the other hand, if $Pd < 1$, "NO" is determined, and the process is restored to the main routine.

[0153] It should be noted that all the four input determinations (S31, S35, S39 and S43) shown in Figure 14 need not be performed, and any one input determination may be performed, or any two or three determinations may be performed in combination.

[0154] As understood from the above description, the game apparatus 10 of this embodiment displays a virtual space on the stereoscopic LCD 12 capable of making an autostereoscopic display (3D display), and images a stereoscopic image for displaying the objects Obj1, Obj2 in a three-dimensional manner (3D display) and a planar image for displaying the objects Obj1, Obj2 in a two-dimensional manner (2D display) with the virtual cameras ICL, ICR in the virtual space.

[0155] The CPU 44a of the game apparatus 10 makes a 3D display on the stereoscopic LCD 12 by using the imaged stereoscopic image (S3, S13a), and makes a 2D display on the stereoscopic LCD 12 by using the imaged planar image (S13b). It should be noted that in place of the stereoscopic image and the planar image imaged by the virtual cameras ICL, ICR, a stereoscopic image and a planar image which are prepared in advance or a stereoscopic image and a planar image which are acquired from outside may be displayed. Furthermore, an input from the touch panel 15, the buttons 24a-24k, the microphone 30, the cameras 18a-18c, etc. is accepted (S5), and in response to this input, the object is controlled (S11). Then, in a case that a non-input state continues over the predetermined period during the 3D display

(S55:NO→S57:YES→S61-S75), the 3D display is switched to the 2D display (S12:YES→S13b). In addition, in a case that there is an input during the 2D display (S81:YES→S87), the CPU 44a switches the 2D display to the 3D display (S12:NO→S13a).

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[0156] Accordingly, if there is no input during the 3D display for a predetermined time, the 3D display is automatically switched to the 2D display, and if there is an input during the 2D display, the 2D display automatically is switched to the 3D display. This saves the player from having to manually switch the stereoscopic mode, capable of enhancing customer convenience.

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[0157] In the above description, the explanation is made on the game apparatus 10, but the present invention can be applied to a display controlling apparatus (PC, PDA, cellular phone, TV, electric photo frame, music/video player, various home information appliances, etc. other than the game apparatus) for displaying a virtual space on an autostereoscopic displayable display. The display (stereoscopic LCD 12, for example) may be contained in the display controlling apparatus, or may be provided separately from the display controlling apparatus. The input device (touch panel 16, buttons 24a-24k, analog pad 26, microphone 30, cameras 18a-18c, etc.) is also contained in or provided separately from the display controlling apparatus. The present invention can be applied to a display controlling system in which respective processing for a display control are distributedly executed by a plurality of computers, etc. In addition, the present invention can be applied to a game program, an application program, etc. for such a display controlling apparatus or such a system.

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[0158] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.

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[0159] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.

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Claims

1. A display controlling program (72) to be executed by a computer (44a) of a display controlling apparatus (10), the display controlling apparatus comprising an autostereoscopic display (12), wherein said display controlling program causes said computer to function as:

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a stereoscopic display (S3, S13a) configured to display a stereoscopic image on said display (12);

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a planar display (S13b) configured to display a planar image on said display (12); an input accepter (S5) configured to accept an input from a predetermined input device (16, 24a-24k, 26, 30, 18a-18c); and a display switcher (S12:YES -->S13b) configured to switch from the display by said stereoscopic display to the display by said planar display in a case that a state that no input is made from said input device to said input accepter continues past a predetermined time during the display by said stereoscopic display (S55:NO-->S57:YES-->S61-S75), characterized in that the display controlling program further causes said computer to function as:

a virtual imager (ICL, ICR) configured for imaging a stereoscopic image for displaying an object (Obj 1, Obj2) in a three-dimensional manner and a planar image for displaying said object in a two-dimensional manner in a virtual space displayed on said display, wherein said stereoscopic display is configured to display a stereoscopic image on said display by utilizing the stereoscopic image imaged by said virtual imager,

said planar display being configured to display a planar image on said display by utilizing the planar image imaged by said virtual imager, wherein said virtual imager is configured to image a left image (44L) and a right image (44R) by a left virtual camera and a right virtual camera (ICL, ICR) arranged at a predetermined space within said virtual space such that said object is included in an imaging range of said left virtual camera and said right virtual camera during the display by said stereoscopic display,

wherein said virtual imager is further configured to image an image such that said object is included in the imaging range by a predetermined virtual camera within said virtual space when said display by said stereoscopic display switches to said display by said planar display,

wherein said virtual imager is configured to perform imaging by moving said left virtual camera and said right virtual camera to a common position in response to a switch from said display by said stereoscopic display to said display by said planar display, and said virtual imager is configured to gradually move said left virtual camera and said right virtual camera to said common position.

2. A display controlling program according to claim 1, wherein said planar display is configured to display any one the left image and the right image that are respectively imaged by said left virtual camera and said right virtual camera. 5
3. A display controlling program according to claim 1, wherein said predetermined virtual camera is positioned midway between said left virtual camera and said right virtual camera. 10
4. A display controlling program according to claim 1, wherein said virtual imager is configured to image a left image (44L) and a right image (44R) by said left virtual camera and said right virtual camera (ICL, ICR) spacedly arranged right and left with respect to said object within said virtual space during the display by said stereoscopic display. 15
5. A display controlling program according to claim 1, wherein said planar display is configured to display any one of the left image and the right image that are respectively imaged by said left virtual camera and said right virtual camera at said common position. 20
6. A display controlling program according to claim 1, wherein said planar display is configured to display the planar image based on both of the left image and the right image that are respectively imaged by said left virtual camera and said right virtual camera at said common position. 25
7. A display controlling program according to any one of claims 1, 4 to 6, wherein said common position is a position midway between the positions of said left virtual camera and said right virtual camera during the display by said stereoscopic display. 30
8. A display controlling program according to claim 1, wherein said virtual imager is configured to move said left virtual camera and said right virtual camera toward said midway position at a uniform velocity. 40
9. A display controlling program according to claim 1, wherein said display switcher (S12:NO ->S13a) is further configured to switch from said display by said planar display to said display by said stereoscopic display in a case that there is an input from said input device to said input accepter during said display by said planar display (S81:YES-->S87). 45
10. A display controlling program according to claim 4, wherein said virtual imager is configured to move right and left said left virtual camera and said right virtual camera that are placed at said common position with respect to said object in response to a switch from said display by said planar display to the display by said stereoscopic display. 50
11. A display controlling program according to claim 1, wherein said virtual imager is configured to image a stereoscopic image which can display an object in a three-dimensional manner and a planar image which can display said object in a two-dimensional manner within said virtual space, and said display controlling program causes said computer to further function as an object controller (S11) which is configured to control said object within said virtual space in response to an input accepted by said input acceptor. 55
12. A display controlling program according to claim 11, wherein said object controller is configured to automatically move said object within said virtual space, and controls, when an input is accepted by said input acceptor, said object in response to said input.
13. A display controlling program according to claim 11, wherein said input device includes a manually operation input device (16, 24a-24k, 26), and said input accepter includes a manually operation input accepter (S21) which is configured to accept a manually operation input from said manually operation input device.
14. A display controlling program according to any one of claims 11 to 13, wherein said input device includes a sound input device (30), and said input accepter includes a sound Input accepter (S23, 72a, 92) which is configured to accept a sound input from said sound input device.
15. A display controlling program according to any one of claims 11 to 14, wherein said input device includes an image input device (18a-18c), and said input accepter includes an image input accepter (S25, 72b, 92) which is configured to accept an image input from said image input device.
16. A display controlling program according to any one of claims 11 to 15, wherein said input device includes a motion input device (54), and said input accepter includes a motion input accepter (S27) which is configured to accept a motion input

- from said motion input device.
- 17.** A display controlling program according to any one of claims 13 to 16, wherein
said display switcher is configured to detect a state
that there is no input from any of said inputter as said
non-input state. 5
- 18.** A display controlling program according to claim 1,
wherein
said display controlling apparatus has a manually
operation input device (16, 24a-24k, 26),
said input accepter includes a manually operation
detector (S21) which is configured to detect a manual
operation input by said manually operation input de- 15
vice, and
said display switcher is configured to regard a state
that no manual operation is detected by said manu-
ally operation detector as said non-input state. 20
- 19.** A display controlling program according to claim 1,
wherein said display controlling apparatus has a
sound input device (30), said input accepter includes
a speech voice detector (S23, 72a, 92) which is con- 25
figured to detect a speech voice from the sound input
by said sound inputter, and
said display switcher is configured to regard a state
that no speech voice is detected by said speech
voice detector as said non-input state. 30
- 20.** A display controlling program according to claim 19,
wherein
said display switcher is configured to regard a state
that no speech voice larger in level than a threshold
value is detected as said non-input state. 35
- 21.** A display controlling program according to claim 1,
wherein
said display controlling apparatus is provided with
an imaging device (18a-18c), said input accepter in- 40
cludes a face detector (S25, 72b, 92) which is con-
figured to detect a facial image from the imaged im-
age imaged by said imaging device, and
said display switcher is configured to regard a state
that no facial image is detected by said face detector 45
as said non-input state.
- 22.** A display controlling program according to claim 21,
wherein said display switcher is configured to regard
a state that no facial image larger in size than a
threshold value is detected as said non-input state. 50
- 23.** A display controlling program according to claim 1,
wherein
said display controlling apparatus is provided with a
motion sensor (54),
said input accepter includes a motion detector (S27)
which is configured to detect a motion of said display 55
- controlling apparatus by said motion sensor, and
said display switcher is configured to regard a state
that no motion larger than a threshold value is de-
tected by said motion detector as said non-input
state.
- 24.** A display controlling program according to claim 1,
wherein
said display is an autostereoscopic displayable dis-
play by a parallax barrier (12b), said display control-
ling program causes said computer to further func-
tion as:

a voltage applying controller (S71, S73) which
is configured to apply a voltage to said parallax
barrier in a case that a stereoscopic display is
performed on said display by said stereoscopic
display, and is configured to not apply a volt-
age to said parallax barrier in a case that a planar
display is performed on said display by said pla-
nar display. 20
- 25.** A display controlling apparatus (10) comprising an
autostereoscopic display (12), wherein
a stereoscopic display (S3, S13a) is configured to
display a stereoscopic image on said display (12);
a planar display (S13b) is configured to display a
planar image on said display (12);
an input accepter (S5) which is configured to accept
an input from a predetermined input device (16, 24a-
24k, 26, 30, 18a-18c); and
a display switcher (S12:YESS13b) which is config-
ured to switch from the display by said stereoscopic
display to the display by said planar display in a
case that a state that no input is made from said input
device to said input accepter continues past a pre-
determined time during the display by said stereo-
scopic display (S55:NO-->S57:YES->S61-S75),
characterized in that the display controlling appa-
ratus further comprises:

a virtual imager (ICL, ICR) configured for imag-
ing a stereoscopic image for displaying an object
(Obj 1, Obj2) in a three-dimensional manner and
a planar image for displaying said object in a
two-dimensional manner in a virtual space dis-
played on said display, wherein said stereo-
scopic display is configured to display a ster-
eoscopic image on said display by utilizing the
stereoscopic image imaged by said virtual im-
ager,
said planar display being configured to display
a planar image on said display by utilizing the
planar image imaged by said virtual imager,
wherein said virtual imager is configured to im-
age a left image (44L) and a right image (44R)
by a left virtual camera and a right virtual camera
(ICL, ICR) arranged at a predetermined space

within said virtual space such that said object is included in an imaging range of said left virtual camera and said right virtual camera during the display by said stereoscopic display, wherein said virtual imager is further configured to image an image such that said object is included in the imaging range by a predetermined virtual camera within said virtual space when said display by said stereoscopic display switches to said display by said planar display, and

wherein said virtual imager is configured to perform imaging by moving said left virtual camera and said right virtual camera to a common position in response to a switch from said display by said stereoscopic display to said display by said planar display, and said virtual imager is configured to gradually move said left virtual camera and said right virtual camera to said common position.

- 26.** A display controlling method by a display controlling apparatus, the display controlling apparatus comprising an autostereoscopic display (12), the display controlling method including the steps of:

a stereoscopic displaying step (S3, S13a) configured to display a stereoscopic image on said display (12);
 a planar displaying step (S13b) configured to display a planar image on said display (12);
 an input accepting step (S5) for accepting an input from a predetermined input device (16, 24a-24k, 26, 30, 18a-18c); and
 a display switching step (S12:YES-->S13b) for switching from the display by said stereoscopic displaying step to the display by said planar displaying step in a case that a non-input state from said input device to said input accepting step continues past a predetermined time during the display by said stereoscopic displaying step (S55:NO-->S57:YES->S61-S75),

characterized in that the method further includes the steps of:

imaging, by a virtual imager (ICL, ICR), a stereoscopic image for displaying an object (Obj 1, Obj2) in a three-dimensional manner and a planar image for displaying said object in a two-dimensional manner in a virtual space displayed on said display, wherein in said stereoscopic displaying step a stereoscopic image is displayed on said display by utilizing the stereoscopic image imaged by said virtual imager, displaying a planar image on said display by utilizing the planar image imaged by said virtual imager,

wherein the imaging by said virtual imager comprises imaging a left image (44L) and a right image (44R) by a left virtual camera and a right virtual camera (ICL, ICR) arranged at a predetermined space within said virtual space such that said object is included in an imaging range of said left virtual camera and said right virtual camera during the display by said stereoscopic display, and

wherein the imaging by said virtual imager further comprises imaging an image such that said object is included in the imaging range by a predetermined virtual camera within said virtual space when said display by said stereoscopic display switches to said display by said planar display, wherein said virtual imager images by moving said left virtual camera and said right virtual camera to a common position in response to a switching from said display by said stereoscopic displaying step to said display by said planar displaying step, and said virtual imager gradually moves said left virtual camera and said right virtual camera to said common position.

- 27.** A display controlling system (10) comprising an auto-stereoscopic display (12), the display controlling system (10) comprising:

a stereoscopic display (S3, S13a) configured to display a stereoscopic image on said display (12);
 a planar display (S13b) configured to display a planar image on said display (12);
 an input accepter (S5) which accepts an input from a predetermined input device (16, 24a-24k, 26, 30, 18a-18c); and
 a display switcher (S12:YES-S13b) which switches from the display by said stereoscopic display to the display by said planar display in a case that a state that no input is made from said input device to said input accepter continues past a predetermined time during the display by said stereoscopic display (S55:NO-S57:YES->S61-S75),

characterized in that the system further comprises:

a virtual imager (ICL, ICR) configured for imaging a stereoscopic image for displaying an object (Obj 1, Obj2) in a three-dimensional manner and a planar image for displaying said object in a two-dimensional manner in a virtual space displayed on said display, wherein said stereoscopic display is configured to display a stereoscopic

image on said display by utilizing the stereoscopic image imaged by said virtual imager,
 said planar display being configured to display a planar image on said display by utilizing the planar image imaged by said virtual imager,
 wherein said virtual imager is configured to image a left image (44L) and a right image (44R) by a left virtual camera and a right virtual camera (ICL, ICR) arranged at a predetermined space within said virtual space such that said object is included in an imaging range of said left virtual camera and said right virtual camera during the display by said stereoscopic display,
 wherein said virtual imager is further configured to image an image such that said object is included in the imaging range by a predetermined virtual camera within said virtual space when said display by said stereoscopic display switches to said display by said planar display,
 wherein said virtual imager is configured to perform imaging by moving said left virtual camera and said right virtual camera to a common position in response to a switch from said display by said stereoscopic display to said display by said planar display, and said virtual imager is configured to gradually move said left virtual camera and said right virtual camera to said common position.

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Patentansprüche

1. Anzeigesteuerprogramm (72), das durch einen Computer (44a) von einer Anzeigesteuervorrichtung (10) ausgeführt werden soll, wobei die Anzeigesteuervorrichtung eine autostereoskopische Anzeige (12) umfasst, wobei
 - das Anzeigesteuerprogramm den Computer dazu veranlasst zu funktionieren als:
 - ein stereoskopischer Anzeiger (S3, S13a), konfiguriert zum Anzeigen eines stereoskopischen Bildes auf der Anzeige (12);
 - ein Planaranzeiger (S13b), konfiguriert zum Anzeigen eines planaren Bildes auf der Anzeige (12);
 - ein Eingabeannehmer (S5), konfiguriert zum Annehmen einer Eingabe von einer vorbestimmten Eingabevorrichtung (16, 24a-24k, 26, 30, i8a-i8c); und
 - ein Anzeigeumschalter (S12:YES-->S13b), konfiguriert zum Umschalten von der Anzeige durch den stereoskopischen Anzeiger zu der

Anzeige durch den Planaranzeiger im Falle dessen, dass ein Zustand in dem keine Eingabe von der Eingabevorrichtung zu dem Eingabeannehmer stattfindet über eine vorbestimmte Zeit während der Anzeige durch den stereoskopischen Anzeiger hinaus andauert (S55:NO-->S57:YES-->S61-S75),

dadurch gekennzeichnet, dass das Anzeigesteuerprogramm ferner den Computer dazu veranlasst zu funktionieren als:

- ein virtueller Bildgeber (ICL, ICR), konfiguriert zum Abbilden eines stereoskopischen Bildes zum Anzeigen eines Objekts (Obj 1, Obj2) in einer dreidimensionalen Weise, und eines planaren Bildes zum Anzeigen des Objekts in einer zweidimensionalen Weise, in einem virtuellen Raum, der auf der Anzeige angezeigt wird, wobei der stereoskopische Anzeiger konfiguriert ist zum Anzeigen eines stereoskopischen Bildes auf der Anzeige mithilfe des stereoskopischen Bildes, das durch den virtuellen Bildgeber abgebildet wird,
- wobei der Planaranzeiger konfiguriert ist zum Anzeigen eines planaren Bildes auf der Anzeige mithilfe des planaren Bildes, welches durch den virtuellen Bildgeber abgebildet wird, wobei der virtuelle Bildgeber konfiguriert ist zum Abbilden eines linken Bildes (44L) und eines rechten Bildes (44R) durch eine linke virtuelle Kamera und eine rechte virtuelle Kamera (ICL, ICR), welche an einem vorbestimmten Raum innerhalb des virtuellen Raums angeordnet sind, sodass das Objekt innerhalb eines Abbildungsbereichs von der linken virtuellen Kamera und der rechten virtuellen Kamera während der Anzeige durch den stereoskopischen Anzeiger eingeschlossen ist,

wobei der virtuelle Bildgeber ferner dazu konfiguriert ist ein Bild abzubilden, sodass das Objekt in dem Abbildungsbereich von einer vorbestimmten virtuellen Kamera innerhalb des virtuellen Raums eingeschlossen ist, wenn die Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger umschaltet, wobei der virtuelle Bildgeber dazu konfiguriert ist Abbilden durchzuführen indem die linke virtuelle Kamera und die rechte virtuelle Kamera zu einer gemeinsamen Position bewegt werden, als Reaktion auf eine Umschaltung von der Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger, und der virtuelle Bildgeber konfiguriert ist allmählich die linke virtuelle Kamera und die rechte virtuelle Kamera zu der gemeinsamen Position zu bewegen.

2. Anzeigesteuerprogramm nach Anspruch 1, wobei

- der Planaranzeiger konfiguriert ist zum Anzeigen von irgendeinem des linken Bildes und des rechten Bildes, welche jeweils durch die linke virtuelle Kamera und die rechte virtuelle Kamera abgebildet werden. 5

3. Anzeigesteuерprogramm nach Anspruch 1, wobei die vorbestimmte virtuelle Kamera auf halbem Wege zwischen der linken virtuellen Kamera und der rechten virtuellen Kamera positioniert ist. 10

4. Anzeigesteuерprogramm nach Anspruch 1, wobei der virtuelle Bildgeber konfiguriert ist zum Abbilden eines linken Bildes (44L) und eines rechten Bildes (44R) durch die linke virtuelle Kamera und die rechte virtuelle Kamera (ICL, ICR), welche im Abstand von einander rechts und links im Bezug auf das Objekt innerhalb des virtuellen Raums während der Anzeige durch den stereoskopischen Anzeiger angeordnet sind. 15

5. Anzeigesteuерprogramm nach Anspruch 1, wobei der Planaranzeiger konfiguriert ist zum Anzeigen von irgendeinem des linken Bildes und des rechten Bildes, welche jeweils durch die linke virtuelle Kamera und die rechte virtuelle Kamera an der gemeinsamen Position abgebildet werden. 20

6. Anzeigesteuерprogramm nach Anspruch 1, wobei der Planaranzeiger konfiguriert ist zum Anzeigen des planaren Bildes basierend auf sowohl dem linken Bild und dem rechten Bild, welche jeweils durch die linke virtuelle Kamera und die rechte virtuelle Kamera an der gemeinsamen Position abgebildet werden. 25

7. Anzeigesteuерprogramm nach irgendeinem der Ansprüche 1, 4 bis 6, wobei die gemeinsame Position eine Position auf halbem Wege zwischen den Positionen der linken virtuellen Kamera und der rechten virtuellen Kamera während der Anzeige durch den stereoskopischen Anzeiger ist. 30

8. Anzeigesteuерprogramm nach Anspruch 1, wobei der virtuelle Bildgeber konfiguriert ist zum Bewegen der linken virtuellen Kamera und der rechten virtuellen Kamera zu der Position auf halbem Wege mit einer einheitlichen Geschwindigkeit. 35

9. Anzeigesteuерprogramm nach Anspruch 1, wobei der Anzeigeumschalter (S12:NO -> S13a) ferner konfiguriert ist zum Umschalten von der Anzeige durch den Planaranzeiger zur Anzeiger durch den stereoskopischen Anzeiger im Falle dessen, dass eine Eingabe von der Eingabevorrichtung zu dem Eingabeannehmer während der Anzeige durch den Planaranzeiger vorliegt (S81:Yes -->S87). 40

10. Anzeigesteuерprogramm nach Anspruch 4, wobei der virtuelle Anzeiger konfiguriert ist zum Bewegen der linken virtuellen Kamera und der rechten virtuellen Kamera, welche sich an der gemeinsamen Position in Bezug auf das Objekt befinden, nach rechts und links, als Reaktion auf eine Umschaltung von der Anzeige durch den Planaranzeiger zu der Anzeige durch den stereoskopischen Anzeiger. 45

11. Anzeigesteuерprogramm nach Anspruch 1, wobei der virtuelle Bildgeber konfiguriert ist zum Abbilden eines stereoskopischen Bildes, welches ein Objekt in einer dreidimensionalen Weise anzeigen kann, sowie eines planaren Bildes, welches das Objekt in einer zweidimensionalen Weise innerhalb des virtuellen Raums anzeigen kann, und das Anzeigesteuерprogramm den Computer ferner veranlasst als ein Objektsteuerer (S11) zu funktionieren, welcher konfiguriert ist zum Steuern des Objekts innerhalb des virtuellen Raums als Reaktion auf eine Eingabe, welche durch den Eingabeannehmer angenommen wird. 50

12. Anzeigesteuерprogramm nach Anspruch 11, wobei der Objektsteuerer konfiguriert ist zum automatischen Bewegen des Objekts innerhalb des virtuellen Raums, und wobei der Objektsteuerer das Objekt als Reaktion auf die Eingabe steuert, wenn eine Eingabe durch den Eingabeannehmer angenommen wurde. 55

13. Anzeigesteuерprogramm nach Anspruch 11, wobei die Eingabevorrichtung eine manuelle Betriebseingabevorrichtung (16, 24a-24k, 26) einschließt, und der Eingabeannehmer einen manuellen Betriebs-eingabeannehmer (S21) einschließt, welcher konfiguriert ist zum Annehmen einer manuellen Betriebs-eingabe von der manuellen Betriebseingabevorrichtung. 60

14. Anzeigesteuерprogramm nach irgendeinem der Ansprüche 11 bis 13, wobei die Eingabevorrichtung eine Geräuscheingabevorrichtung (30) einschließt, und der Eingabeannehmer einen Geräuscheingabeannehmer (S23, 72a, 92) einschließt, welcher konfiguriert ist zum Annehmen einer Geräuscheingabe von der Geräuscheingabevorrichtung. 65

15. Anzeigesteuерprogramm nach irgendeinem der Ansprüche 11 bis 14, wobei die Eingabevorrichtung eine Bildeingabevorrichtung (18a-18c) einschließt, und der Eingabeannehmer einen Bildeingabeannehmer (S25, 72b, 92) einschließt, welcher konfiguriert ist zum Annehmen einer Bildeingabe von der Bildeingabevorrichtung. 70

16. Anzeigesteuерprogramm nach irgendeinem der An-

- sprüche 11 bis 15, wobei die Eingabevorrichtung eine Bewegungseingabevorrichtung (54) einschließt, und der Eingabenehmer einen Bewegungseingabenehmer (S27) einschließt, welcher konfiguriert ist zum Annehmen einer Bewegungseingabe von der Bewegungseingabevorrichtung.
17. Anzeigesteuerprogramm nach irgendeinem der Ansprüche 13 bis 16, wobei der Anzeigeumschalter konfiguriert ist zum Erkennen eines Zustands, dass es keine Eingabe von irgendeinem von den Eingeben gibt, als den Nichteingabezustand.
18. Anzeigesteuerprogramm nach Anspruch 1, wobei die Anzeigesteuervorrichtung eine manuelle Betriebseingabevorrichtung (16, 24a-24k, 26) aufweist, der Eingabenehmer einen manuellen Betriebserkenner (S21) einschließt, welcher konfiguriert ist zum Erkennen einer manuellen Betriebseingabe durch die manuelle Betriebseingabevorrichtung, und der Anzeigeumschalter konfiguriert ist zum Betrachten eines Zustands, dass kein manueller Betrieb durch den manuellen Betriebserkenner erkannt wird, als den Nichteingabezustand.
19. Anzeigesteuerprogramm nach Anspruch 1, wobei die Anzeigesteuervorrichtung eine Geräuscheingabevorrichtung (30) aufweist, der Eingabenehmer einen Sprachstimmenerkenner (S23, 72a, 92) einschließt, welcher konfiguriert ist zum Erkennen einer Sprachstimme von der Geräuscheingabe durch den Geräuscheingeber, und der Anzeigeumschalter konfiguriert ist zum Betrachten eines Zustands, dass keine Sprachstimme durch den Sprachstimmenerkenner erkannt wird, als den Nichteingabezustand.
20. Anzeigesteuerprogramm nach Anspruch 19, wobei der Anzeigeumschalter konfiguriert ist zum Betrachten eines Zustands, dass keine Sprachstimme mit einem größeren Pegel als ein Grenzwert erkannt wird, als den Nichteingabezustand.
21. Anzeigesteuerprogramm nach Anspruch 1, wobei die Anzeigesteuervorrichtung über eine Abbildungsvorrichtung (18a-18c) verfügt, der Eingabenehmer einen Gesichtserkenner (S25, 72b, 92) einschließt, welcher konfiguriert ist zum Erkennen eines Gesichtsbilds von dem abgebildeten Bild, welches durch die Abbildungsvorrichtung abgebildet wird, und der Anzeigeumschalter konfiguriert ist zum Betrachten eines Zustands, dass kein Gesichtsbild durch den Gesichtserkenner erkannt wird, als den Nichteingabezustand.
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22. Anzeigesteuerprogramm nach Anspruch 21, wobei der Anzeigeumschalter konfiguriert ist zum Betrachten eines Zustands, in dem kein Gesichtsbild mit einer größeren Größe als ein Grenzwert erkannt wird, als den Nichteingabezustand.
23. Anzeigesteuerprogramm nach Anspruch 1, wobei die Anzeigesteuervorrichtung über einen Bewegungssensor (54) verfügt, der Eingabenehmer einen Bewegungserkenner (S27) einschließt, welcher konfiguriert ist zum Erkennen einer Bewegung von der Anzeigesteuervorrichtung durch den Bewegungssensor, und der Anzeigeumschalter konfiguriert ist zum Betrachten eines Zustands, dass keine Bewegung größer als ein Grenzwert durch den Bewegungserkenner erkannt wird, als den Nichteingabezustand.
24. Anzeigesteuerprogramm nach Anspruch 1, wobei die Anzeige eine autostereoskopische, anzeigbare Anzeige durch eine Parallaxenschanke (12b) ist, wobei das Anzeigesteuerprogramm den Computer ferner dazu veranlasst zu funktionieren als:
- ein Spannungsanlegungssteuerer (S71, S73), welcher konfiguriert ist zum Anlegen einer Spannung an die Parallaxenschanke in einem Fall, dass eine stereoskopische Anzeige auf einer Anzeige durch den stereoskopischen Anzeiger durchgeführt wird, und welche konfiguriert ist keine Spannung an die Parallaxenschanke anzulegen, in einem Fall, dass eine Planaranzeige auf der Anzeige durch den Planaranzeiger durchgeführt wird.
25. Anzeigesteuervorrichtung (10) umfassend eine autostereoskopische Anzeige (12), wobei
- ein stereoskopischer Anzeiger (S3, S13a) zum Anzeigen eines stereoskopischen Bildes auf der Anzeige (12) konfiguriert ist;
 - ein Planaranzeiger (S13b) zum Anzeigen eines planaren Bildes auf der Anzeige (12) konfiguriert ist;
 - ein Eingabenehmer (S5), welcher zum Annehmen einer Eingabe von einer vorbestimmten Eingabevorrichtung (16, 24a-24k, 26, 30, 18a-18c) konfiguriert ist; und
 - ein Anzeigeumschalter (S12:YES-->S13b) konfiguriert ist zum Umschalten von der Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger im Falle dessen, dass ein Zustand, in dem keine Eingabe von der Eingabevorrichtung zu dem Eingabenehmer stattfindet, über eine vorbestimmte Zeit während der Anzeige durch den stereoskopischen Anzeiger hinaus andauert (S55:NO->S57:YES-->S61-S75),

dadurch gekennzeichnet, dass die Anzeigesteuervorrichtung ferner umfasst:

- einen virtuellen Bildgeber (ICL, ICR), konfiguriert zum Abbilden eines stereoskopischen Bildes zum Anzeigen eines Objekts (Obj 1, Obj2) in einer dreidimensionalen Weise, und eines planaren Bildes zum Anzeigen des Objekts in einer zweidimensionalen Weise, in einem virtuellen Raum, der auf der Anzeige angezeigt wird, wobei der stereoskopische Anzeiger konfiguriert ist zum Anzeigen eines stereoskopischen Bildes auf der Anzeige mithilfe des stereoskopischen Bildes, das durch den virtuellen Bildgeber abgebildet wird,
- wobei der Planaranzeiger konfiguriert ist zum Anzeigen eines planaren Bildes auf der Anzeige mithilfe des planaren Bildes, welches mithilfe des virtuellen Bildgebers abgebildet wird,

wobei der virtuelle Bildgeber konfiguriert ist zum Abbilden eines linken Bildes (44L) und eines rechten Bildes (44R) durch eine linke virtuelle Kamera und eine rechte virtuelle Kamera (ICL, ICR), welche an einem vorbestimmten Raum innerhalb des virtuellen Raums angeordnet sind, sodass das Objekt innerhalb eines Abbildungsbereichs von der linken virtuellen Kamera und der rechten virtuellen Kamera während der Anzeige durch den stereoskopischen Anzeiger eingeschlossen ist,

wobei der virtuelle Bildgeber ferner dazu konfiguriert ist ein Bild abzubilden, sodass das Objekt in dem Abbildungsbereich von einer vorbestimmten virtuellen Kamera innerhalb des virtuellen Raums eingeschlossen ist, wenn die Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger umschaltet,

wobei der virtuelle Bildgeber dazu konfiguriert ist Abbilden durchzuführen indem die linke virtuelle Kamera und die rechte virtuelle Kamera zu einer gemeinsamen Position bewegt werden, als Reaktion auf eine Umschaltung von der Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger, und der virtuelle Bildgeber konfiguriert ist allmählich die linke virtuelle Kamera und die rechte virtuelle Kamera zu der gemeinsamen Position zu bewegen.

26. Ein Anzeigesteuerverfahren durch eine Anzeigesteuervorrichtung, die Anzeigesteuervorrichtung umfassend eine autostereoskopische Anzeige (12), wobei das Anzeigesteuerverfahren die Schritte einschließt von:

- einen stereoskopischen Anzeigeschritt (S3, S13a), konfiguriert zum Anzeigen eines stereoskopischen Bildes auf der Anzeige (12);
- einen Planaranzeigeschritt (S13b), konfiguriert

zum Anzeigen eines planaren Bildes auf der Anzeige (12);

- einen Eingabeannahmerschritt (S5) zum Annehmen einer Eingabe von einer vorbestimmten Eingabevorrichtung (16, 24a-24k, 26, 30, 18a-18c); und
- einen Anzeigeumschalterschritt (S12:YES-->S13b) zum Umschalten von der Anzeige durch den stereoskopischen Anzeigeschritt zu der Anzeige durch den Planaranzeigeschritt im Falle dessen, dass ein Nichteingabezustand, in dem keine Eingabe von der Eingabevorrichtung zu dem Eingabeannahmerschritt stattfindet, über eine vorbestimmte Zeit während der Anzeige durch den stereoskopischen Anzeigeschritt hinaus andauert (S55:NO-->S57:YES-->S61-S75),

dadurch gekennzeichnet, dass das Verfahren ferner die Schritte einschließt von:

- Abbilden, durch einen virtuellen Bildgeber (ICL, ICR), eines stereoskopischen Bildes zum Anzeigen eines Objekts (Obj1, Obj2) in einer dreidimensionalen Weise, und eines planaren Bildes zum Anzeigen des Objekts in einer zweidimensionalen Weise, in einem virtuellen Raum, der auf der Anzeige angezeigt wird, wobei in dem stereoskopischen Anzeigeschritt ein stereoskopisches Bild auf der Anzeige mithilfe des stereoskopischen Bildes, das durch den virtuellen Bildgeber abgebildet wird, angezeigt wird,
- Anzeigen eines planaren Bildes auf der Anzeige mithilfe des planaren Bildes, welches durch den virtuellen Bildgeber abgebildet wird,

wobei das Abbilden durch den virtuellen Bildgeber Abbilden eines linken Bildes (44L) und eines rechten Bildes (44R) durch eine linke virtuelle Kamera und eine rechte virtuelle Kamera (ICL, ICR) umfasst, welche an einem vorbestimmten Raum innerhalb des virtuellen Raums angeordnet sind, sodass das Objekt innerhalb eines Abbildungsbereichs von der linken virtuellen Kamera und der rechten virtuellen Kamera während der Anzeige durch den stereoskopischen Anzeiger eingeschlossen ist,

wobei das Abbilden durch den virtuellen Bildgeber ferner umfasst ein Bild abzubilden, sodass das Objekt in dem Abbildungsbereich von einer vorbestimmten virtuellen Kamera innerhalb des virtuellen Raums eingeschlossen ist, wenn die Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger umschaltet,

wobei der virtuelle Bildgeber abbildet, indem die linke virtuelle Kamera und die rechte virtuelle Kamera zu einer gemeinsamen Position bewegt werden, als Reaktion auf eine Umschaltung von der Anzeige durch den stereoskopischen Anzeigeschritt zu der

Anzeige durch den Planaranzeigeschritt, und der virtuelle Bildgeber allmählich die linke virtuelle Kamera und die rechte virtuelle Kamera zu der gemeinsamen Position bewegt.	5	während der Anzeige durch den stereoskopischen Anzeiger eingeschlossen ist, wobei der virtuelle Bildgeber ferner dazu konfiguriert ist ein Bild abzubilden, sodass das Objekt in dem Abbildungsbereich von einer vorbestimmten virtuellen Kamera innerhalb des virtuellen Raums eingeschlossen ist, wenn die Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger umschaltet,
27. Anzeigesteuersystem (10) umfassend eine autostereoskopische Anzeige (12), wobei das Anzeigesteuersystem (10) umfasst:		wobei der virtuelle Bildgeber dazu konfiguriert ist Abbilden durchzuführen, indem die linke virtuelle Kamera und die rechte virtuelle Kamera zu einer gemeinsamen Position bewegt werden, als Reaktion auf eine Umschaltung von der Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger, und der virtuelle Bildgeber konfiguriert ist allmählich die linke virtuelle Kamera und die rechte virtuelle Kamera zu der gemeinsamen Position zu bewegen.
- einen stereoskopischen Anzeiger (S3, S13a), konfiguriert zum Anzeigen eines stereoskopischen Bildes auf der Anzeige (12);	10	
- einen Planaranzeiger (S13b), konfiguriert zum Anzeigen eines planaren Bildes auf der Anzeige (12);	15	
- einen Eingabeannehmer (S5), welcher eine Eingabe von einer vorbestimmten Eingabevorrichtung (16, 24a-24k, 26, 30, 18a--18c) annimmt; und	20	
- einen Anzeigeumschalter (S12:YES-->S13b), welcher von der Anzeige durch den stereoskopischen Anzeiger zu der Anzeige durch den Planaranzeiger umschaltet im Falle dessen, dass ein Zustand, in dem keine Eingabe von der Eingabevorrichtung zu dem Eingabeannehmer stattfindet über eine vorbestimmte Zeit während der Anzeige durch den stereoskopischen Anzeiger hinaus andauert (S55:NO-->S57:YES-->S61-S75),	25	
dadurch gekennzeichnet, dass das System ferner umfasst:	30	
- einen virtuellen Bildgeber (ICL, ICR), konfiguriert zum Abbilden eines stereoskopischen Bildes zum Anzeigen eines Objekts (Obj1, Obj2) in einer dreidimensionalen Weise, und eines planaren Bildes zum Anzeigen des Objekts in einer zweidimensionalen Weise, in einem virtuellen Raum, der auf der Anzeige angezeigt wird, wobei der stereoskopische Anzeiger konfiguriert ist zum Anzeigen eines stereoskopischen Bildes auf der Anzeige mithilfe des stereoskopischen Bildes, das durch den virtuellen Bildgeber abgebildet wird,	35	un afficheur stéréoscopique (S3, S13a) configuré pour afficher une image stéréoscopique sur ledit affichage (12) ;
- wobei der Planaranzeiger konfiguriert ist zum Anzeigen eines planaren Bildes auf der Anzeige mithilfe des planaren Bildes, welches durch den virtuellen Bildgeber abgebildet wird,	40	un afficheur plan (S13b) configuré pour afficher une image plane sur ledit affichage (12) ;
wobei der virtuelle Bildgeber konfiguriert ist zum Abbilden eines linken Bildes (44L) und eines rechten Bildes (44R) durch eine linke virtuelle Kamera und eine rechte virtuelle Kamera (ICL, ICR), welche an einem vorbestimmten Raum innerhalb des virtuellen Raums angeordnet sind, sodass das Objekt innerhalb eines Abbildungsbereichs von der linken virtuellen Kamera und der rechten virtuellen Kamera	45	un accepteur d'entrée (S5) configuré pour accepter une entrée en provenance d'un dispositif d'entrée prédéterminé (16, 24a-24k, 26, 30, 18a-18c) ; et
	50	un commutateur d'affichage (S12:YES-->S13b) configuré pour commuter de l'affichage par ledit afficheur stéréoscopique à l'affichage par ledit afficheur plan dans un cas où un état dans lequel aucune entrée n'est produite depuis ledit dispositif d'entrée vers ledit accepteur d'entrée se prolonge au-delà d'un temps prédéterminé durant l'affichage par ledit afficheur stéréoscopique (S55:NO-->S57:YES-->S61-S75),
	55	caractérisé en ce que le programme de contrôle d'affichage fait en outre en sorte que ledit calculateur opère comme :
		un imageur virtuel (ICL, ICR) configuré pour imager une image stéréoscopique pour l'affichage d'un objet (Obj1, Obj2) d'une manière tridimensionnelle et une image plane pour l'affichage dudit objet d'une manière

- bidimensionnelle dans un espace virtuel affiché sur ledit affichage, ledit afficheur stéréoscopique étant configuré pour afficher une image stéréoscopique sur ledit affichage par utilisation de l'image stéréoscopique imagée par ledit imageur virtuel,
 ledit afficheur plan étant configuré pour afficher une image plane sur ledit affichage par utilisation de l'image plane imagée par ledit imageur virtuel, ledit imageur virtuel étant configuré pour imager une image gauche (44L) et une image droite (44R) par une caméra virtuelle gauche et une caméra virtuelle droite (ICL, ICR) agencées au niveau d'un espace prédéterminé au sein dudit espace virtuel de telle sorte que ledit objet soit inclus dans un champ d'imagerie de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite durant l'affichage par ledit afficheur stéréoscopique,
 dans lequel ledit imageur virtuel est en outre configuré pour imager une image telle que ledit objet soit inclus dans le champ d'imagerie par une caméra virtuelle prédéterminée au sein dudit espace virtuel lorsque ledit affichage par ledit afficheur stéréoscopique commute vers ledit affichage par ledit afficheur plan,
 dans lequel ledit imageur virtuel est configuré pour effectuer l'imagerie par déplacement de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite vers une position commune en réponse à une commutation depuis ledit affichage par ledit afficheur stéréoscopique vers ledit affichage par ledit afficheur plan, et ledit imageur virtuel est configuré pour déplacer graduellement ladite caméra virtuelle gauche et ladite caméra virtuelle droite vers ladite position commune.
2. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit afficheur plan est configuré pour afficher l'une quelconque de l'image gauche et de l'image droite qui sont respectivement imagées par ladite caméra virtuelle gauche et ladite caméra virtuelle droite.
3. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ladite caméra virtuelle prédéterminée est positionnée à mi-chemin de ladite caméra virtuelle gauche de ladite caméra virtuelle droite.
4. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit imageur virtuel est configuré pour imager une image gauche (44L) et une image droite (44R) par ladite caméra virtuelle gauche et ladite caméra virtuelle droite (ICL, ICR) agencées à distance à droite et à gauche par rapport audit objet au sein dudit espace virtuel durant l'affichage par ledit afficheur stéréoscopique.
5. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit afficheur plan est configuré pour afficher l'une quelconque de l'image gauche et de l'image droite qui sont respectivement imagées par ladite caméra virtuelle gauche et ladite caméra virtuelle droite au niveau de ladite position commune.
10. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit afficheur plan est configuré pour afficher l'image plane sur la base à la fois de l'image gauche et de l'image droite qui sont respectivement imagées par ladite caméra virtuelle gauche et ladite caméra virtuelle droite au niveau de ladite position commune.
15. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit afficheur plan est configuré pour afficher l'image plane sur la base à la fois de l'image gauche et de l'image droite qui sont respectivement imagées par ladite caméra virtuelle gauche et ladite caméra virtuelle droite au niveau de ladite position commune.
20. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit afficheur plan est configuré pour afficher l'image plane sur la base à la fois de l'image gauche et de l'image droite qui sont respectivement imagées par ladite caméra virtuelle gauche et ladite caméra virtuelle droite au niveau de ladite position commune.
25. Un programme de contrôle d'affichage selon l'une des revendications 1, 4 à 6, dans lequel ladite position commune est une position à mi-chemin des positions de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite pendant l'affichage par ledit afficheur stéréoscopique.
30. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit imageur virtuel est configuré pour déplacer ladite caméra virtuelle gauche et ladite caméra virtuelle droite en direction de ladite position à mi-chemin avec une vitesse uniforme.
35. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit commutateur d'affichage (S12:NO-->S13a) est en outre configuré pour commuter dudit affichage par ledit afficheur plan audit affichage par ledit afficheur stéréoscopique dans un cas où il y a une entrée en provenance dudit dispositif d'entrée vers ledit accepteur d'entrée pendant ledit affichage par ledit afficheur plan (S81:YES-->S87).
40. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit imageur virtuel est configuré pour déplacer vers la droite et vers la gauche ladite caméra virtuelle gauche et ladite caméra virtuelle droite qui sont placées au niveau de ladite position commune par rapport audit objet en réponse à une commutation dudit affichage par ledit afficheur plan vers l'affichage par ledit afficheur stéréoscopique.
45. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit imageur virtuel est configuré pour déplacer vers la droite et vers la gauche ladite caméra virtuelle gauche et ladite caméra virtuelle droite qui sont placées au niveau de ladite position commune par rapport audit objet en réponse à une commutation dudit affichage par ledit afficheur plan vers l'affichage par ledit afficheur stéréoscopique.
50. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit imageur virtuel est configuré pour déplacer vers la droite et vers la gauche ladite caméra virtuelle gauche et ladite caméra virtuelle droite qui sont placées au niveau de ladite position commune par rapport audit objet en réponse à une commutation dudit affichage par ledit afficheur plan vers l'affichage par ledit afficheur stéréoscopique.
55. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit imageur virtuel est configuré pour déplacer vers la droite et vers la gauche ladite caméra virtuelle gauche et ladite caméra virtuelle droite qui sont placées au niveau de ladite position commune par rapport audit objet en réponse à une commutation dudit affichage par ledit afficheur plan vers l'affichage par ledit afficheur stéréoscopique.

- ledit afficheur virtuel est configuré pour imager une image stéréoscopique qui peut afficher un objet d'une manière tridimensionnelle et une image plane qui peut afficher ledit objet d'une manière bidimensionnelle au sein dudit espace virtuel, et ledit programme de contrôle d'affichage fait en sorte que ledit calculateur opère en outre comme un contrôleur d'objet (S11) qui est configuré pour contrôler ledit objet au sein dudit espace virtuel en réponse à une entrée acceptée par ledit accepteur d'entrée.
12. Un programme de contrôle d'affichage selon la revendication 11, dans lequel ledit contrôleur d'objet est configuré pour déplacer automatiquement ledit objet au sein dudit espace virtuel, et contrôle, lorsqu'une entrée est acceptée par ledit accepteur d'entrée, ledit objet en réponse à ladite entrée.
13. Un programme de contrôle d'affichage selon la revendication 11, dans lequel ledit dispositif d'entrée comprend un dispositif d'entrée à actionnement manuel (16, 24a-24k, 26) et ledit accepteur d'entrée comprend un accepteur d'entrée à fonctionnement manuel (S21) qui est configuré pour accepter une entrée à actionnement manuel à partir dudit dispositif d'entrée à actionnement manuel.
14. Un programme de contrôle d'affichage selon l'une des revendications 11 à 13, dans lequel ledit dispositif d'entrée comprend un dispositif d'entrée sonore (30), et ledit accepteur d'entrée comprend un accepteur d'entrée sonore (S23, 72a, 92) qui est configuré pour accepter une entrée sonore provenant dudit dispositif d'entrée sonore.
15. Un programme de contrôle d'affichage selon l'une des revendications 11 à 14, dans lequel ledit dispositif d'entrée comprend un dispositif d'entrée d'image (18a-18c) et ledit accepteur d'entrée comprend un accepteur d'entrée d'image (S25, 72b, 92) qui est configuré pour accepter une entrée d'image en provenance dudit dispositif d'entrée d'image.
16. Un programme de contrôle d'affichage selon l'une des revendications 11 à 15, dans lequel ledit dispositif d'entrée comprend un dispositif d'entrée de mouvement (54), et ledit accepteur d'entrée comprend un accepteur d'entrée de mouvement (S27) qui est configuré pour accepter une entrée de mouvement provenant dudit dispositif d'entrée de mouvement.
17. Un programme de contrôle d'affichage selon l'une des revendications 13 à 16, dans lequel ledit commutateur d'affichage est configuré pour dé-
tecter comme étant ledit état d'absence d'entrée un état dans lequel il n'y a aucune entrée provenant d'un quelconque desdits organes d'entrée.
- 5 18. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit appareil de contrôle d'affichage possède un dispositif d'entrée à actionnement manuel (16, 24a-24k, 26), ledit accepteur d'entrée comprend un détecteur d'actionnement manuel (S21) qui est configuré pour détecter une entrée d'actionnement manuel par ledit dispositif d'entrée d'actionnement manuel, et ledit commutateur d'affichage est configuré pour considérer comme étant ledit état d'absence d'entrée un état dans lequel aucun actionnement manuel n'est détecté par ledit détecteur d'actionnement manuel.
- 10 19. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit appareil de contrôle d'affichage possède un dispositif d'entrée sonore (30), ledit accepteur d'entrée comprend un détecteur vocal de parole (S23, 72a, 92) qui est configuré pour détecter une voix parlée provenant de l'entrée sonore par ledit organe d'entrée sonore, et ledit commutateur d'affichage est configuré pour considérer comme étant ledit état d'absence d'entrée un état dans lequel aucune voix parlée n'est détectée par ledit détecteur vocal de parole.
- 15 20. Un programme de contrôle d'affichage selon la revendication 19, dans lequel ledit commutateur d'entrée est configuré pour considérer comme étant ledit état d'absence d'entrée un état dans lequel aucune voix parlée de niveau supérieur à une valeur de seuil n'est détectée.
- 20 21. Un programme de contrôle d'affichage selon la revendication 1, dans lequel ledit appareil de contrôle d'affichage est pourvu d'un dispositif d'imagerie (18a-18c), ledit accepteur d'entrée comprend un détecteur de visage (S25, 72b, 92) qui est configuré pour détecter une image d'un visage provenant de l'image imagée qui est imagée par ledit dispositif d'imagerie, et ledit commutateur d'affichage est configuré pour considérer comme étant ledit état d'absence d'entrée un état dans lequel aucune image de visage n'est détectée par ledit détecteur de visage.
- 25 22. Un programme de contrôle d'affichage selon la revendication 21, dans lequel ledit commutateur d'affichage est configuré pour considérer comme étant ledit état d'absence d'entrée un état dans lequel aucune image de visage de taille supérieure à une valeur de seuil n'est détectée.
- 30 23. Un programme de contrôle d'affichage selon la re-

- vendication 1, dans lequel
ledit appareil de contrôle d'affichage est pourvu d'un capteur de mouvement (54), ledit accepteur d'entrée comprend un détecteur de mouvement (S27) qui est configuré pour détecter un mouvement dudit appareil de contrôle d'affichage par ledit capteur de mouvement, et
ledit commutateur d'affichage est configuré pour considérer comme étant ledit état d'absence d'entrée un état dans lequel aucun mouvement supérieur à une valeur de seuil n'est détecté par ledit détecteur de mouvement.
- 24.** Un programme de contrôle d'affichage selon la revendication 1, dans lequel
ledit affichage est un affichage qui peut être affiché autostéréoscopique par une barrière de parallaxe (12b), ledit programme de contrôle d'affichage faisant en sorte que ledit calculateur opère en outre comme :
un contrôleur d'application de tension (S71, S73) qui est configuré pour appliquer une tension à ladite barrière de parallaxe dans un cas où un affichage stéréoscopique est réalisé sur ledit affichage par ledit afficheur stéréoscopique, et est configuré pour ne pas appliquer de tension à ladite barrière de parallaxe dans un cas où un affichage plan est réalisé sur ledit affichage par ledit afficheur plan.
- 25.** Un appareil de contrôle d'affichage (10) comprenant un affichage autostéréoscopique (12), dans lequel un afficheur stéréoscopique (S3, S13a) est configuré pour afficher une image stéréoscopique sur ledit affichage (12) ; un afficheur plan (S13b) est configuré pour afficher une image plane sur ledit affichage (12) ; un accepteur d'entrée (S5) est configuré pour accepter une entrée en provenance d'un dispositif d'entrée prédéterminé (16, 24a-24k, 26, 30, 18a-18c) ; et un commutateur d'affichage (S12:YES-->S13b) est configuré pour commuter de l'affichage par ledit afficheur stéréoscopique à l'affichage par ledit afficheur plan dans un cas où un état dans lequel aucune entrée n'est produite depuis ledit dispositif d'entrée vers ledit accepteur d'entrée se prolonge au-delà d'un temps prédéterminé durant l'affichage par ledit afficheur stéréoscopique (S55:NO->S57:YES-->S61-S75),
caractérisé en ce que l'appareil de contrôle d'affichage comprend en outre :
un imageur virtuel (ICL, ICR) configuré pour imager une image stéréoscopique pour l'affichage d'un objet (Obj1, Obj2) d'une manière tridimensionnelle et une image plane pour l'affichage du dit objet d'une manière bidimensionnelle dans un espace virtuel affiché sur ledit affichage, ledit afficheur stéréoscopique étant configuré pour afficher une image stéréoscopique sur ledit affichage par utilisation de l'image stéréoscopique imagée par ledit imageur virtuel, ledit afficheur plan étant configuré pour afficher une image plane sur ledit affichage par utilisation de l'image plane imagée par ledit imageur virtuel, dans lequel ledit imageur virtuel est configuré pour imager une image gauche (44L) et une image droite (44R) par une caméra virtuelle gauche et une caméra virtuelle droite (ICL, ICR) agencées au niveau d'un espace prédéterminé au sein dudit espace virtuel de telle sorte que ledit objet soit inclus dans un champ d'imagerie de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite durant l'affichage par ledit afficheur stéréoscopique, dans lequel ledit imageur virtuel est en outre configuré pour imager une image telle que ledit objet soit inclus dans le champ d'imagerie par une caméra virtuelle prédéterminée au sein dudit espace virtuel lorsque ledit affichage par ledit afficheur stéréoscopique commute vers ledit affichage par ledit afficheur plan, dans lequel ledit imageur virtuel est configuré pour effectuer l'imagerie par déplacement de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite vers une position commune en réponse à une commutation depuis ledit affichage par ledit afficheur stéréoscopique vers ledit affichage par ledit afficheur plan, et ledit imageur virtuel est configuré pour déplacer graduellement ladite caméra virtuelle gauche et ladite caméra virtuelle droite vers ladite position commune.
- 26.** Un procédé de contrôle d'affichage par un appareil de contrôle d'affichage, l'appareil de contrôle d'affichage comprenant un affichage autostéréoscopique (12), le procédé de contrôle d'affichage comprenant les étapes suivantes :
une étape d'affichage stéréoscopique (S3, S13a) configurée pour afficher une image stéréoscopique sur ledit affichage (12) ; une étape d'affichage plan (S13b) configurée pour afficher une image plane sur ledit affichage (12) ; une étape d'acceptation d'entrée (S5) pour accepter une entrée en provenance d'un dispositif d'entrée prédéterminé (16, 24a-24k, 26, 30, 18a-18c) ; et une étape de commutation d'affichage (S12:YES-->S13b) pour commuter de l'affichage par ledit afficheur stéréoscopique à l'affichage

ge par ledit afficheur plan dans un cas où un état d'absence d'entrée depuis ledit dispositif d'entrée vers ledit accepteur d'entrée se prolonge au-delà d'un temps prédéterminé durant l'affichage par ledit afficheur stéréoscopique (S55:NO-->S57:YES-->S61-S75),
caractérisé en ce que le procédé comprend en outre les étapes suivantes :

- imagerie, par un imageur virtuel (ICL, ICR), d'une image stéréoscopique pour l'affichage d'un objet (Obj1, Obj2) d'une manière tridimensionnelle et d'une image plane pour l'affichage dudit objet d'une manière bidimensionnelle dans un espace virtuel affiché sur ledit affichage, où à ladite étape d'affichage une image stéréoscopique est affichée sur ledit affichage par utilisation de l'image stéréoscopique imagée par ledit imageur virtuel, 10
affichage d'une image plane sur ledit affichage par utilisation de l'image plane imagée par ledit imageur virtuel, 20
l'imagerie par ledit imageur virtuel comprenant l'imagerie d'une image gauche (44L) et d'une image droite (44R) par une caméra virtuelle gauche et une caméra virtuelle droite (ICL, ICR) agencées au niveau d'un espace prédéterminé au sein dudit espace virtuel de telle sorte que ledit objet soit inclus dans un champ d'imagerie de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite durant l'affichage par ledit afficheur stéréoscopique, et 25
l'imagerie par ledit imageur virtuel comprenant en outre l'imagerie d'une image telle que ledit objet soit inclus dans le champ d'imagerie par une caméra virtuelle prédéterminée au sein dudit espace virtuel lorsque ledit affichage par ledit afficheur stéréoscopique commute vers ledit affichage par ledit afficheur plan, 30
ledit imageur virtuel effectuant l'imagerie par déplacement de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite vers une position commune en réponse à une commutation depuis ledit affichage par ledit afficheur stéréoscopique vers ledit affichage par ledit afficheur plan, et ledit imageur virtuel déplaçant graduellement ladite caméra virtuelle gauche et ladite caméra virtuelle droite vers ladite position commune, 35
ledit imageur virtuel effectuant l'imagerie par déplacement de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite vers une position commune en réponse à une commutation depuis ledit affichage par ledit afficheur stéréoscopique vers ledit affichage par ledit afficheur plan, 40
ledit imageur virtuel effectuant l'imagerie par déplacement de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite vers une position commune en réponse à une commutation depuis ledit affichage par ledit afficheur stéréoscopique vers ledit affichage par ledit afficheur plan, 45
ledit imageur virtuel effectuant l'imagerie par déplacement de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite vers une position commune en réponse à une commutation depuis ledit affichage par ledit afficheur stéréoscopique vers ledit affichage par ledit afficheur plan, 50
27. Un système de contrôle d'affichage (10) comprenant un affichage autostéréoscopique (12), le système de contrôle d'affichage (10) comprenant : 55

un afficheur stéréoscopique (S3, S13a) configuré pour afficher une image stéréoscopique sur ledit affichage (12) ;
un afficheur plan (S13b) configuré pour afficher une image plane sur ledit affichage (12) ;
un accepteur d'entrée (S5) qui accepte une entrée en provenance d'un dispositif d'entrée prédéterminé (16, 24a-24k, 26, 30, 18a-18c) ; et un commutateur d'affichage (S12:YES-->S13b) qui commute de l'affichage par ledit afficheur stéréoscopique à l'affichage par ledit afficheur plan dans un cas où un état dans lequel aucune entrée n'est produite depuis ledit dispositif d'entrée vers ledit accepteur d'entrée se prolonge au-delà d'un temps prédéterminé durant l'affichage par ledit afficheur stéréoscopique (S55:NO-->S57:YES-->S61-S75),
caractérisé en ce que le système comprend en outre :

un imageur virtuel (ICL, ICR) configuré pour imager une image stéréoscopique pour l'affichage d'un objet (Obj1, Obj2) d'une manière tridimensionnelle et une image plane pour l'affichage dudit objet d'une manière bidimensionnelle dans un espace virtuel affiché sur ledit affichage, ledit afficheur stéréoscopique étant configuré pour afficher une image stéréoscopique sur ledit affichage par utilisation de l'image stéréoscopique imagée par ledit imageur virtuel,
ledit afficheur plan étant configuré pour afficher une image plane sur ledit affichage par utilisation de l'image plane imagée par ledit imageur virtuel,
ledit imageur virtuel étant configuré pour imager une image gauche (44L) et une image droite (44R) par une caméra virtuelle gauche et une caméra virtuelle droite (ICL, ICR) agencées au niveau d'un espace prédéterminé au sein dudit espace virtuel de telle sorte que ledit objet soit inclus dans un champ d'imagerie de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite durant l'affichage par ledit afficheur stéréoscopique,
dans lequel ledit imageur virtuel est en outre configuré pour imager une image telle que ledit objet soit inclus dans le champ d'imagerie par une caméra virtuelle prédéterminée au sein dudit espace virtuel lorsque ledit affichage par ledit afficheur stéréoscopique commute vers ledit affichage par ledit afficheur plan,
dans lequel ledit imageur virtuel est configuré pour effectuer l'imagerie par déplacement de ladite caméra virtuelle gauche et de ladite caméra virtuelle droite vers une

position commune en réponse à une commutation depuis ledit affichage par ledit afficheur stéréoscopique vers ledit affichage par ledit afficheur plan, et ledit imageur virtuel est configuré pour déplacer graduellement ladite caméra virtuelle gauche et ladite caméra virtuelle droite vers ladite position commune.

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FIG. 1

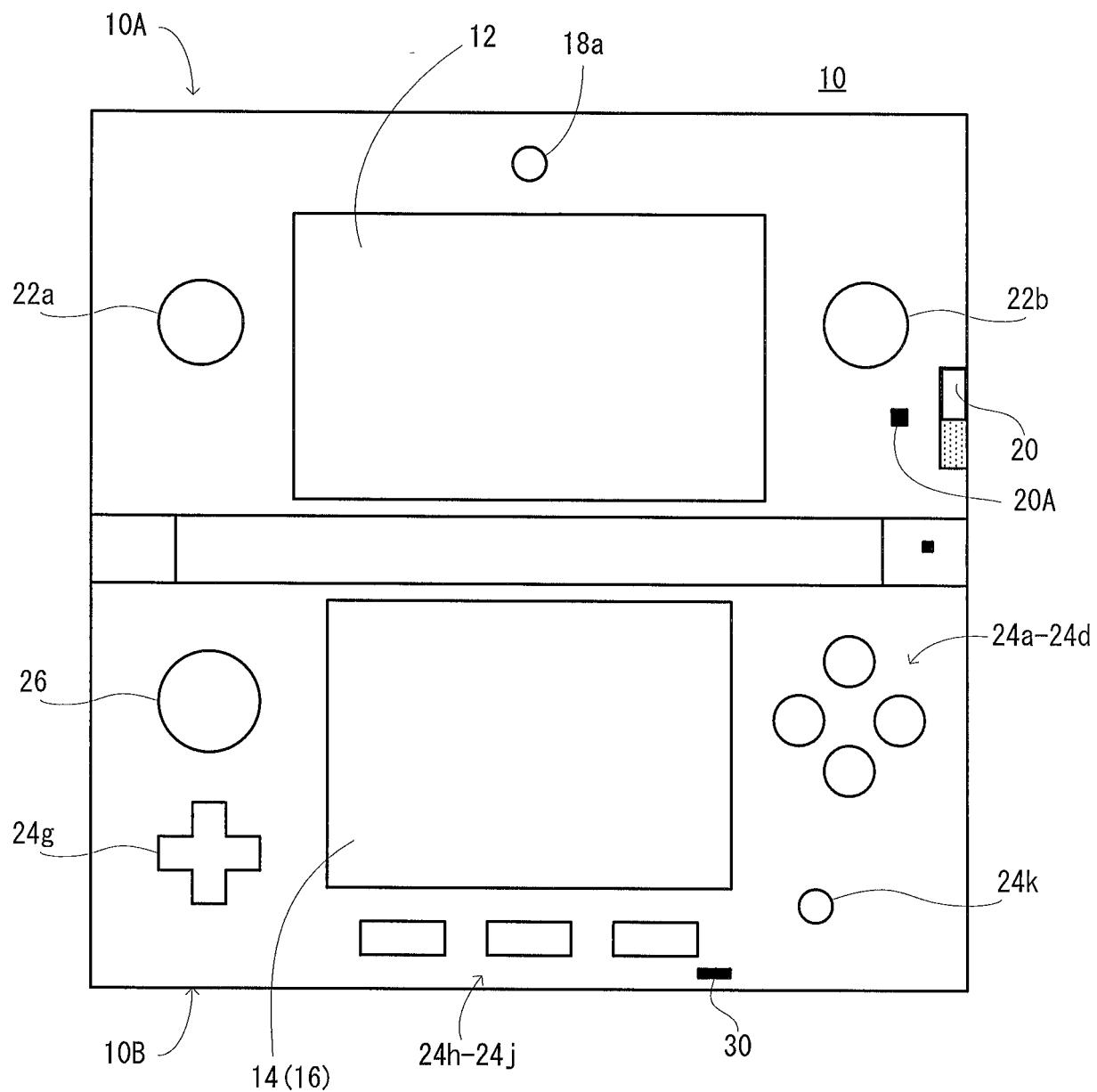


FIG. 2

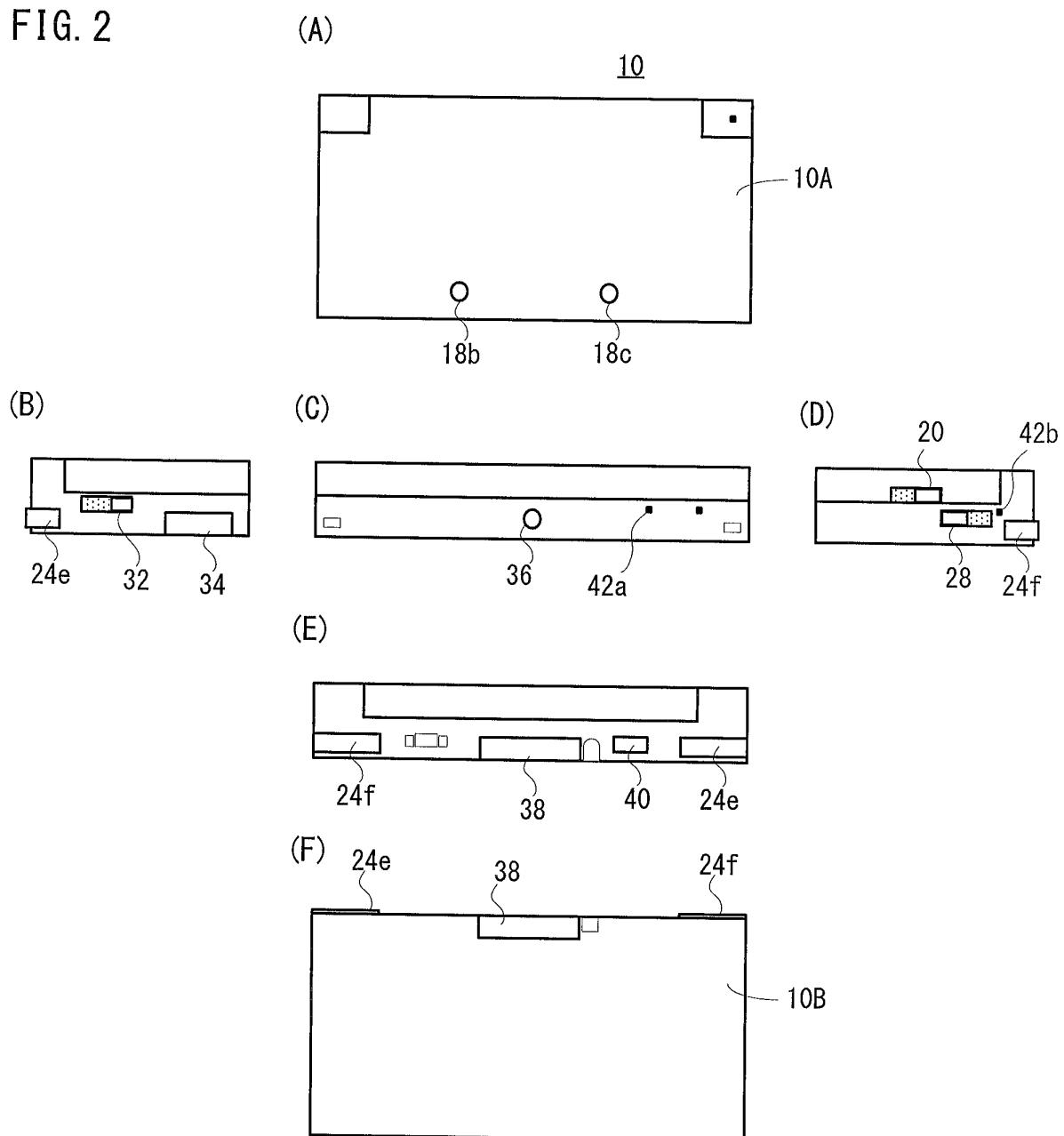


FIG. 3

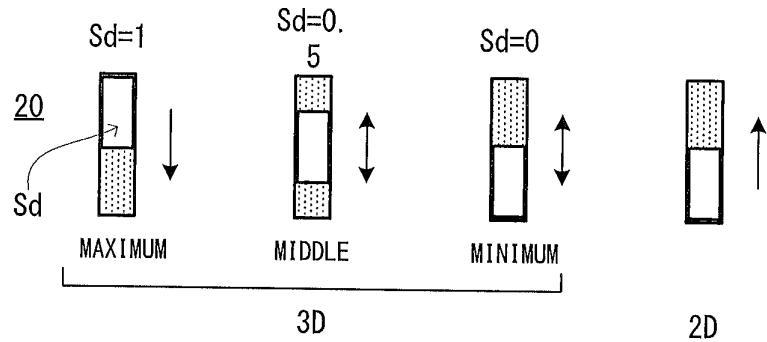
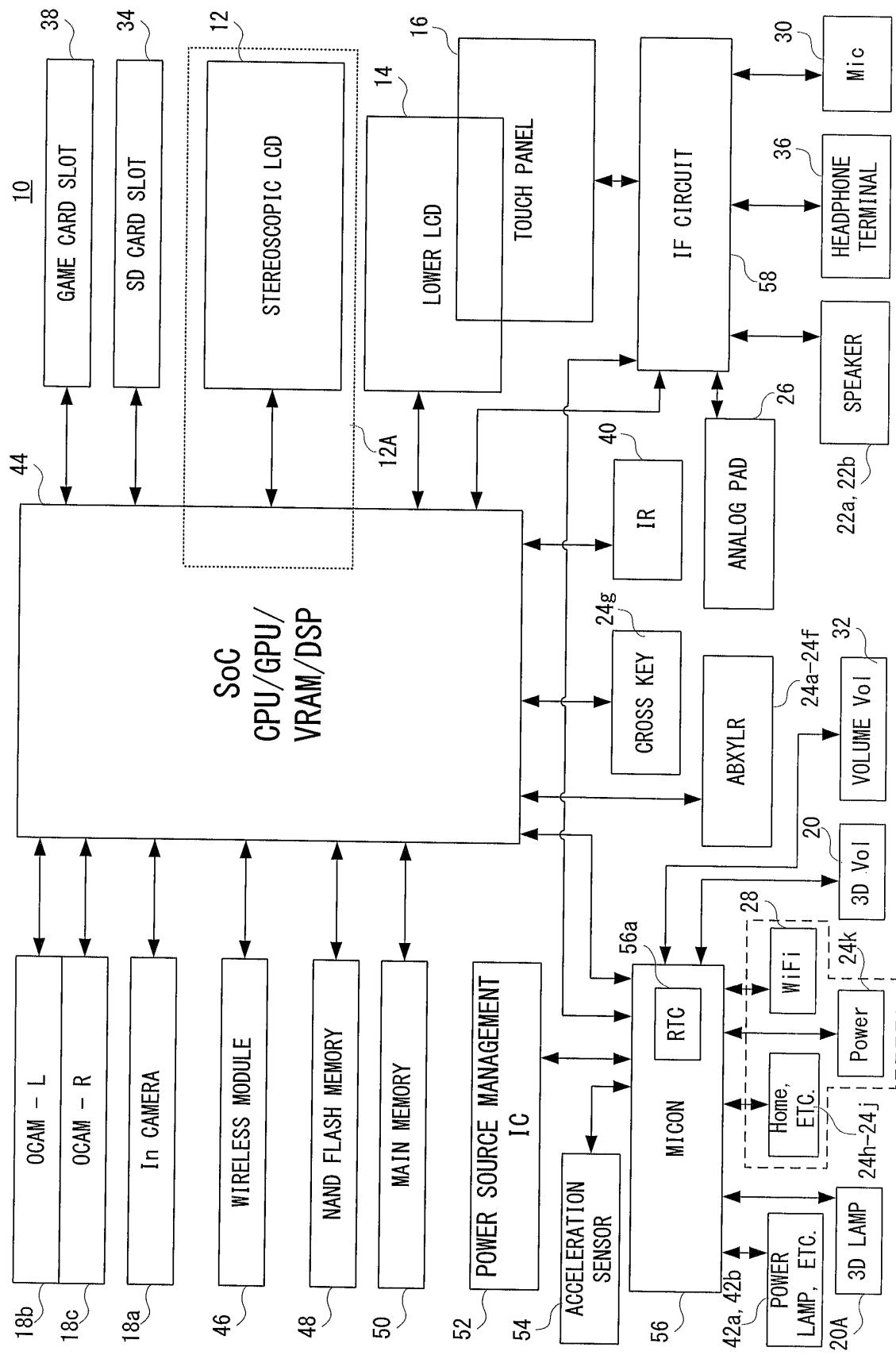


FIG. 4



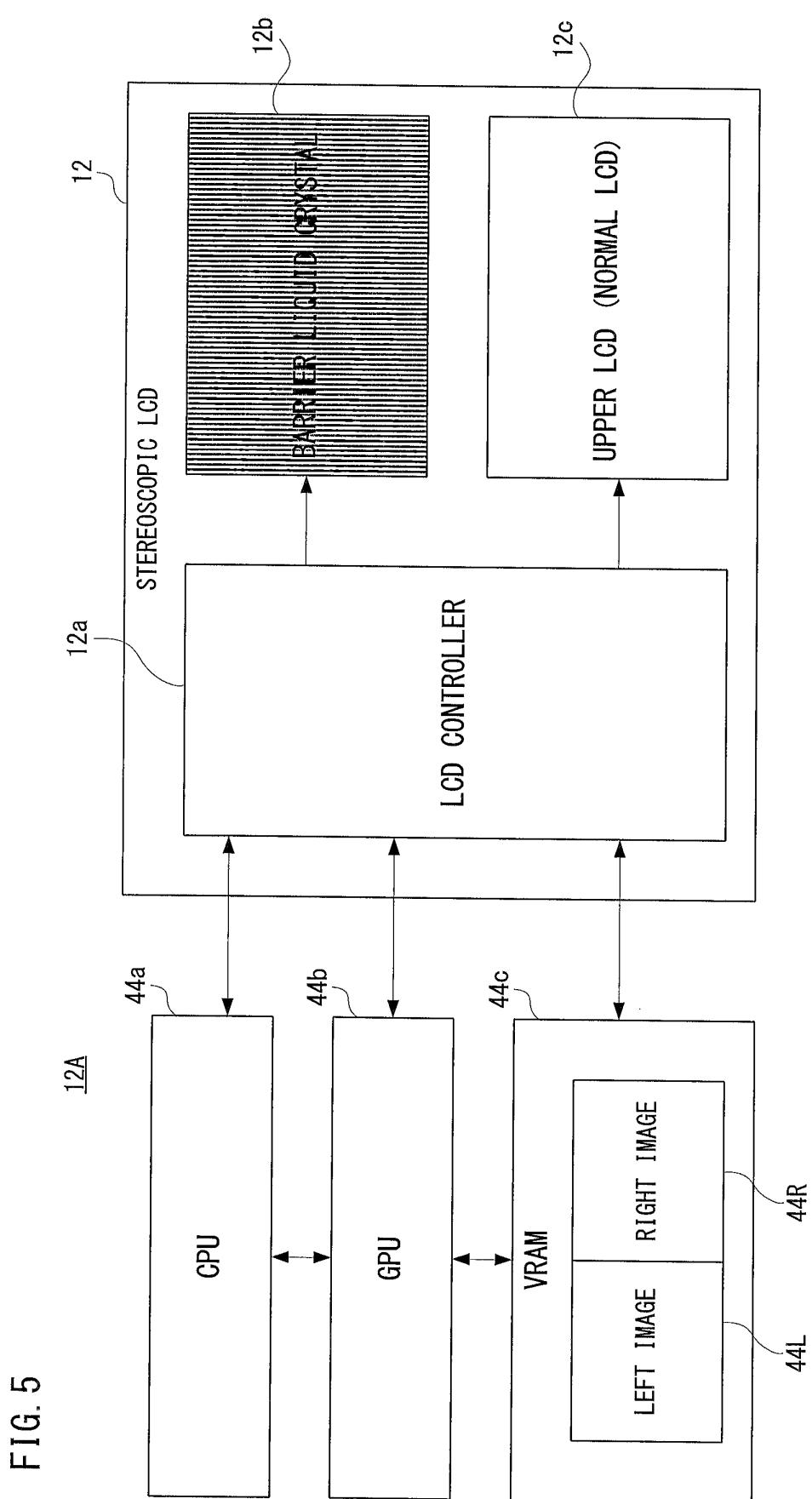
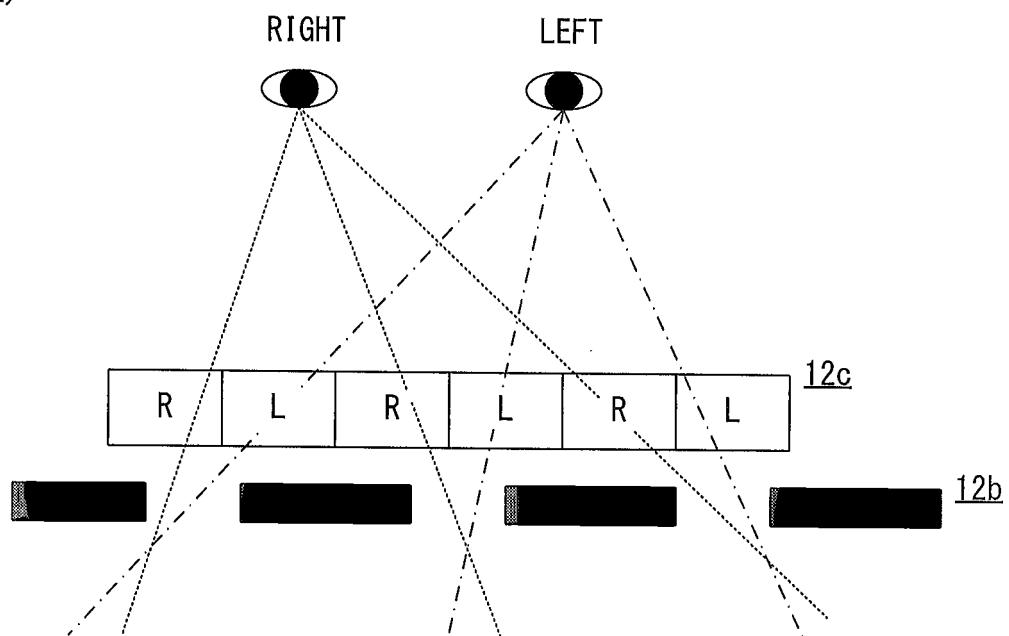


FIG. 6

(A)



(B)

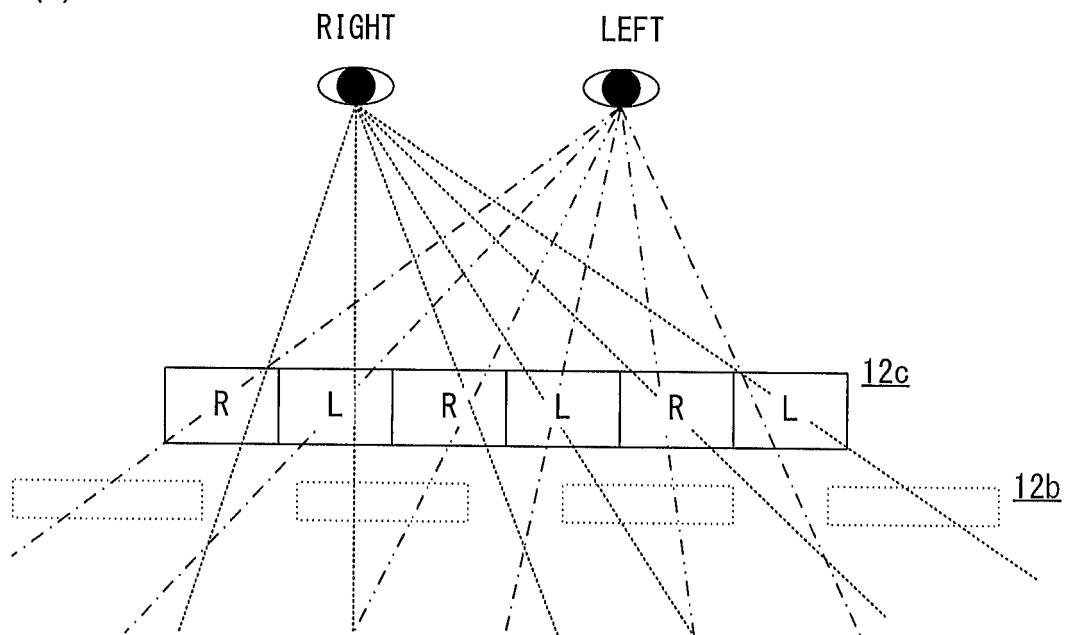


FIG. 7

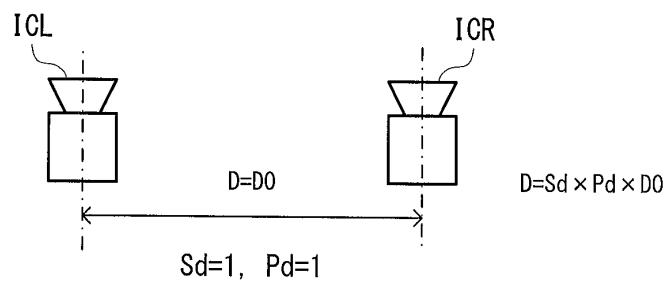
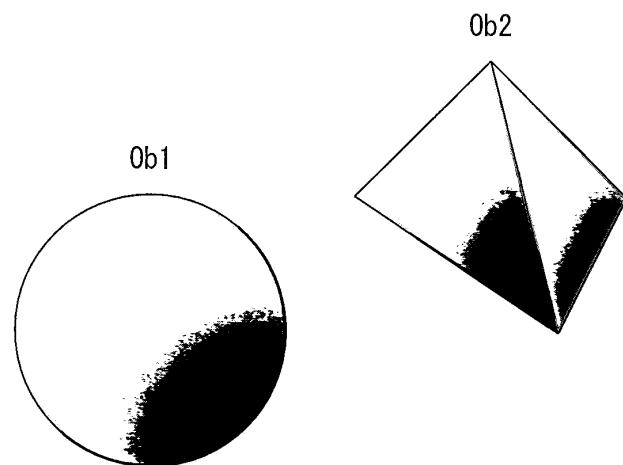


FIG. 8

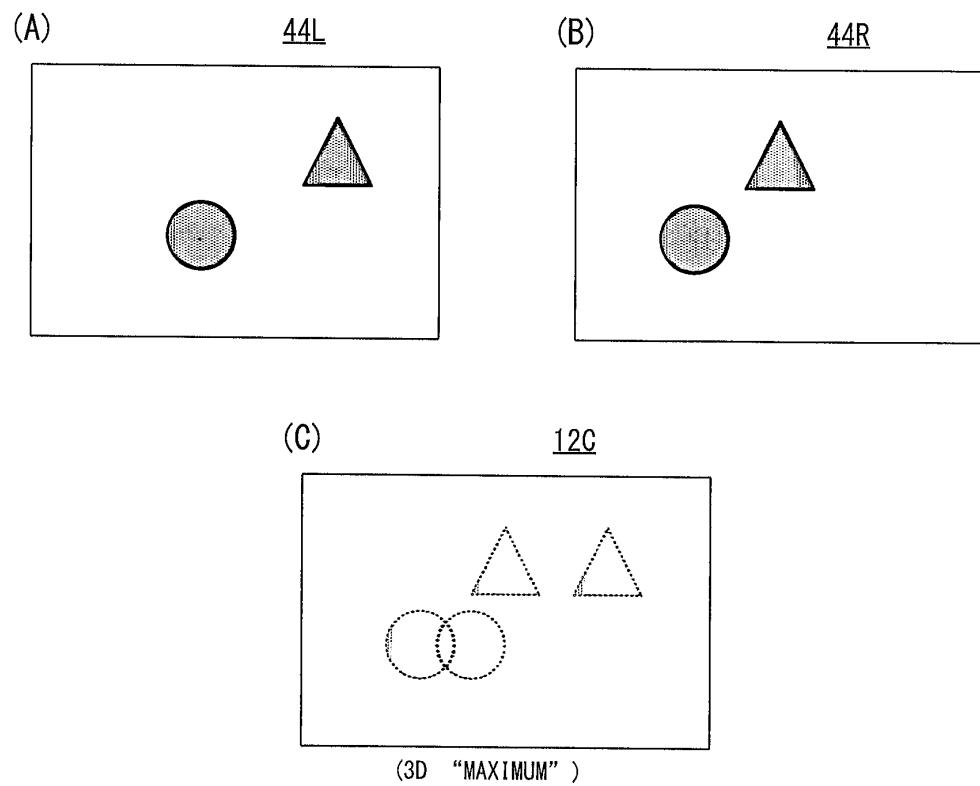
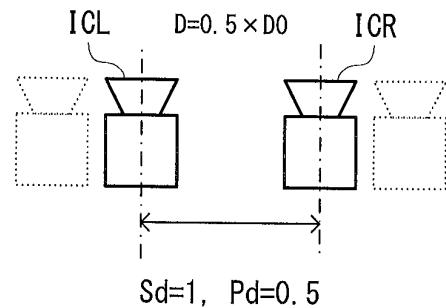


FIG. 9

(A)



(B)

12C

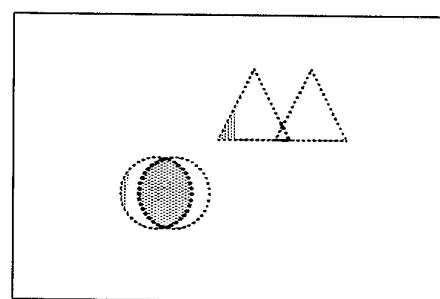
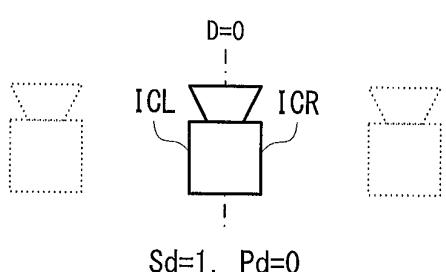


FIG. 10

(A)



(B)

12C

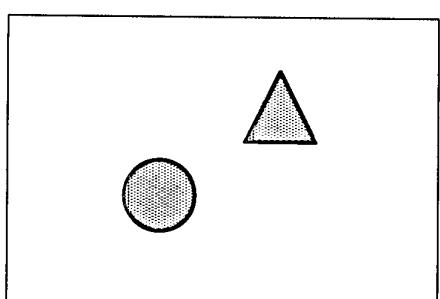


FIG. 11

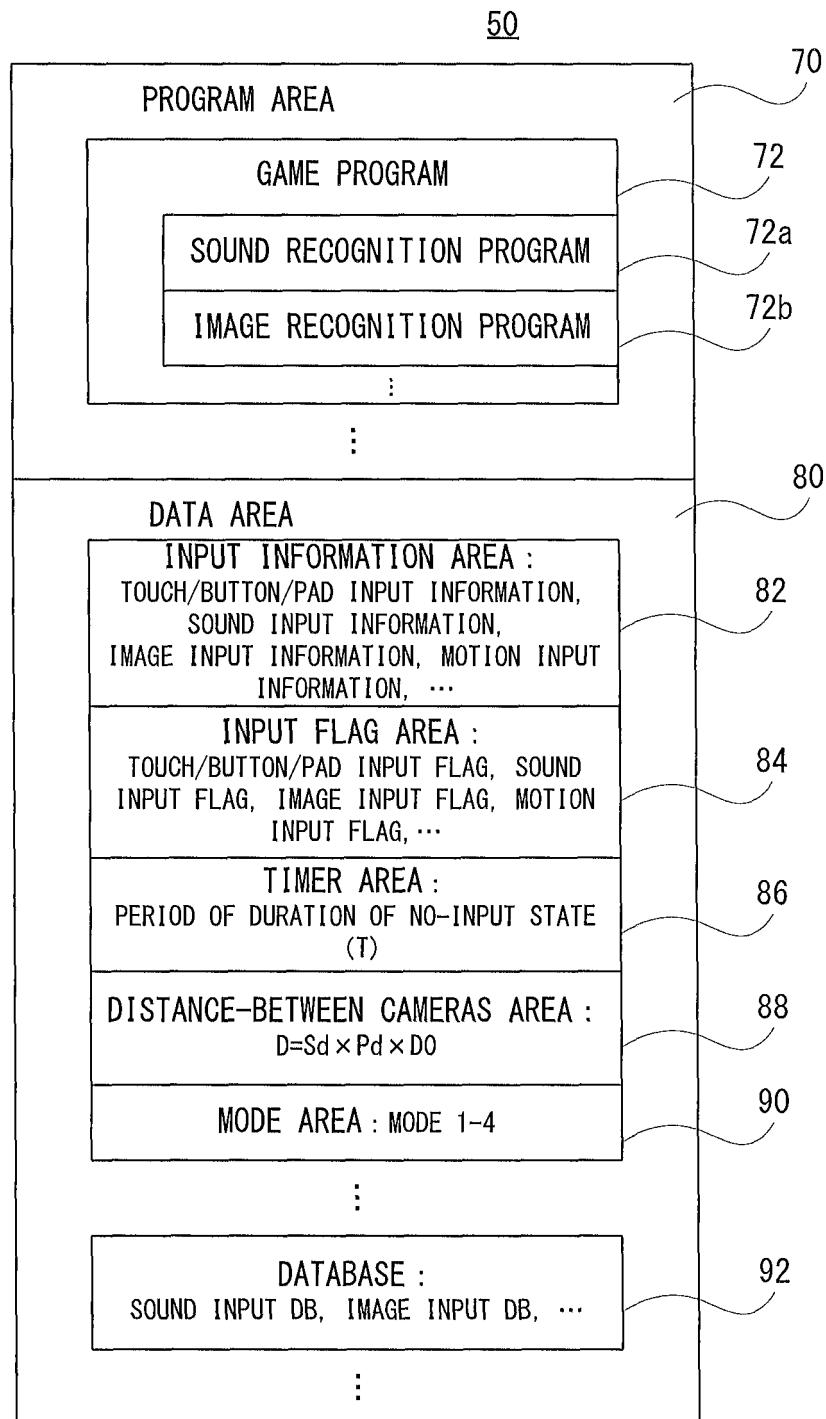


FIG. 12

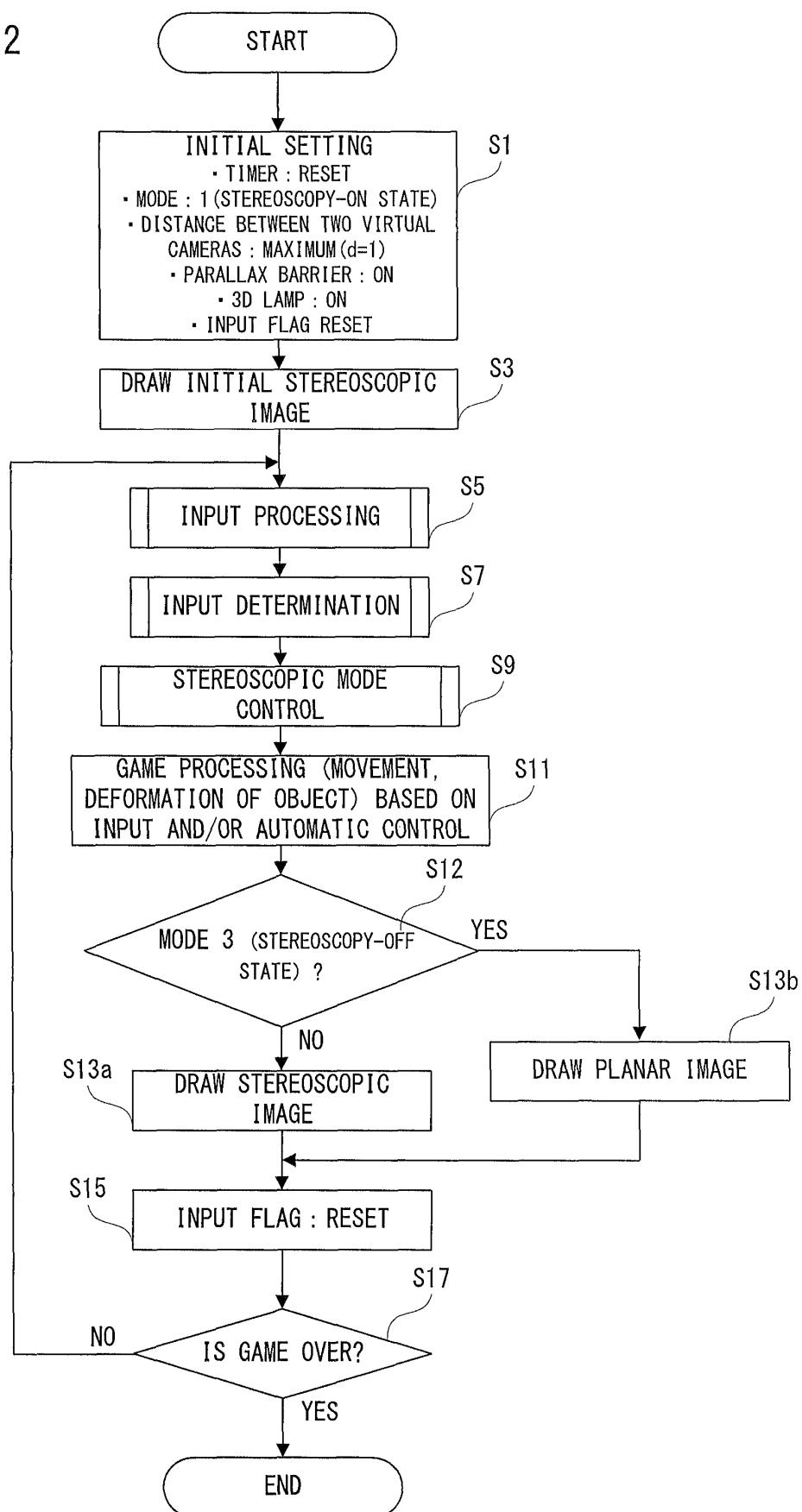


FIG. 13

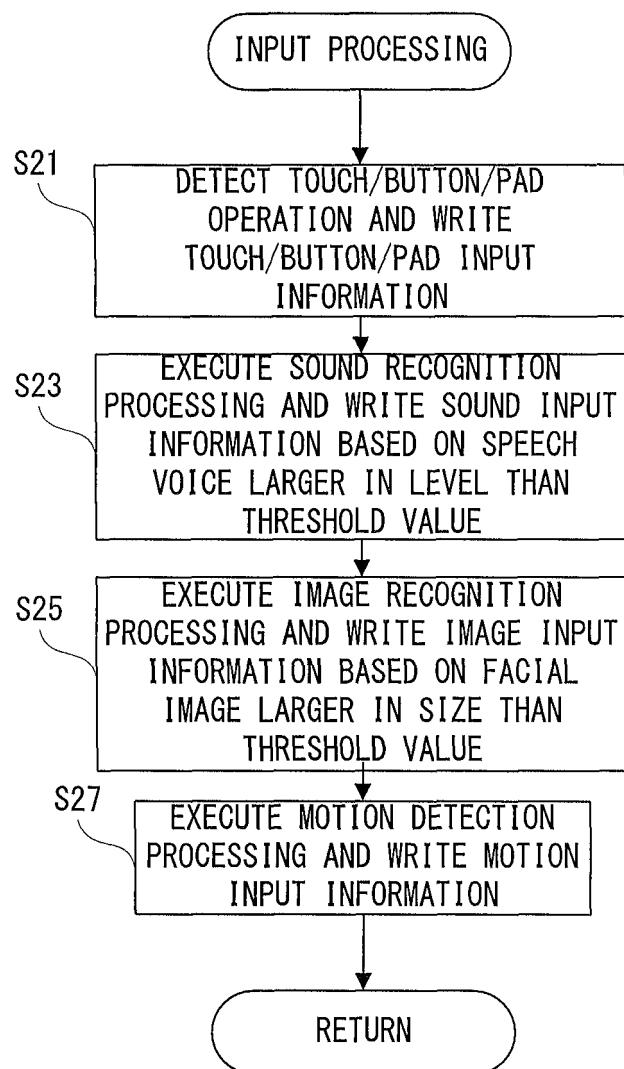


FIG. 14

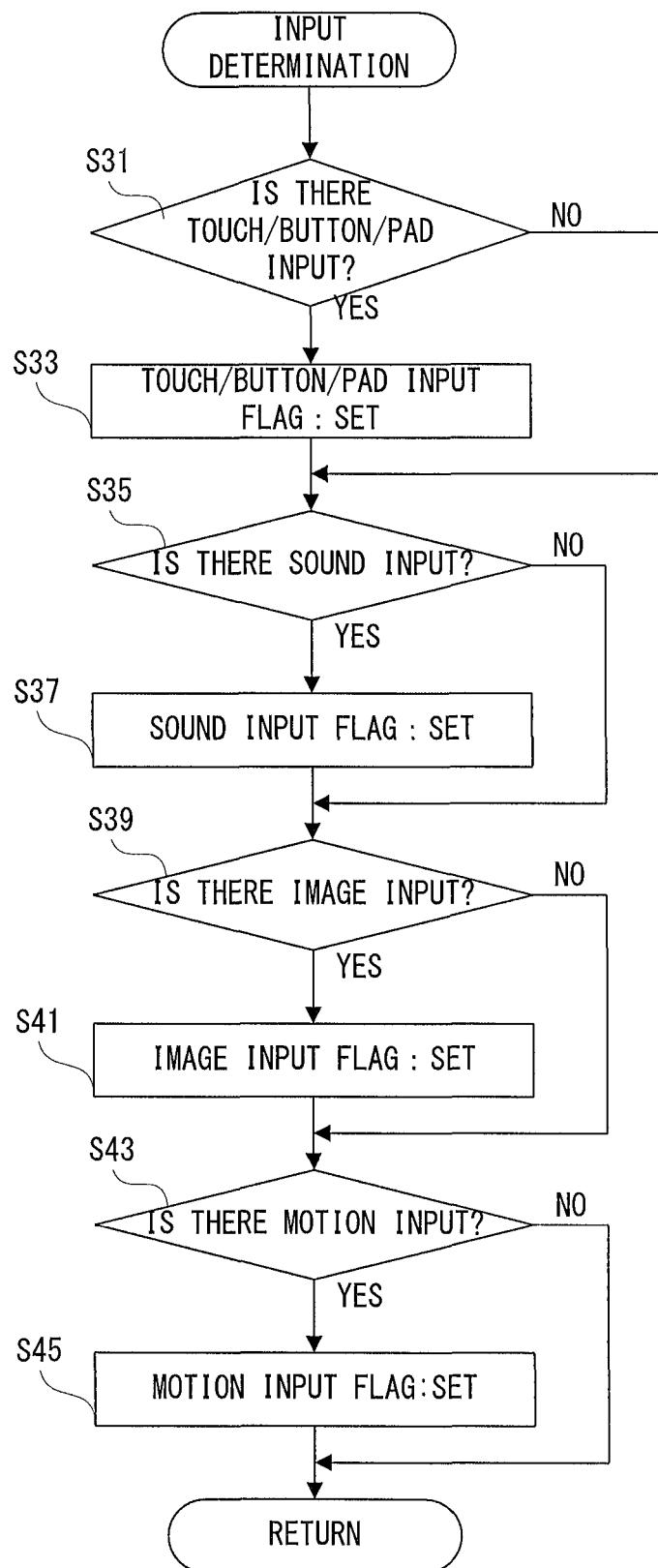


FIG. 15

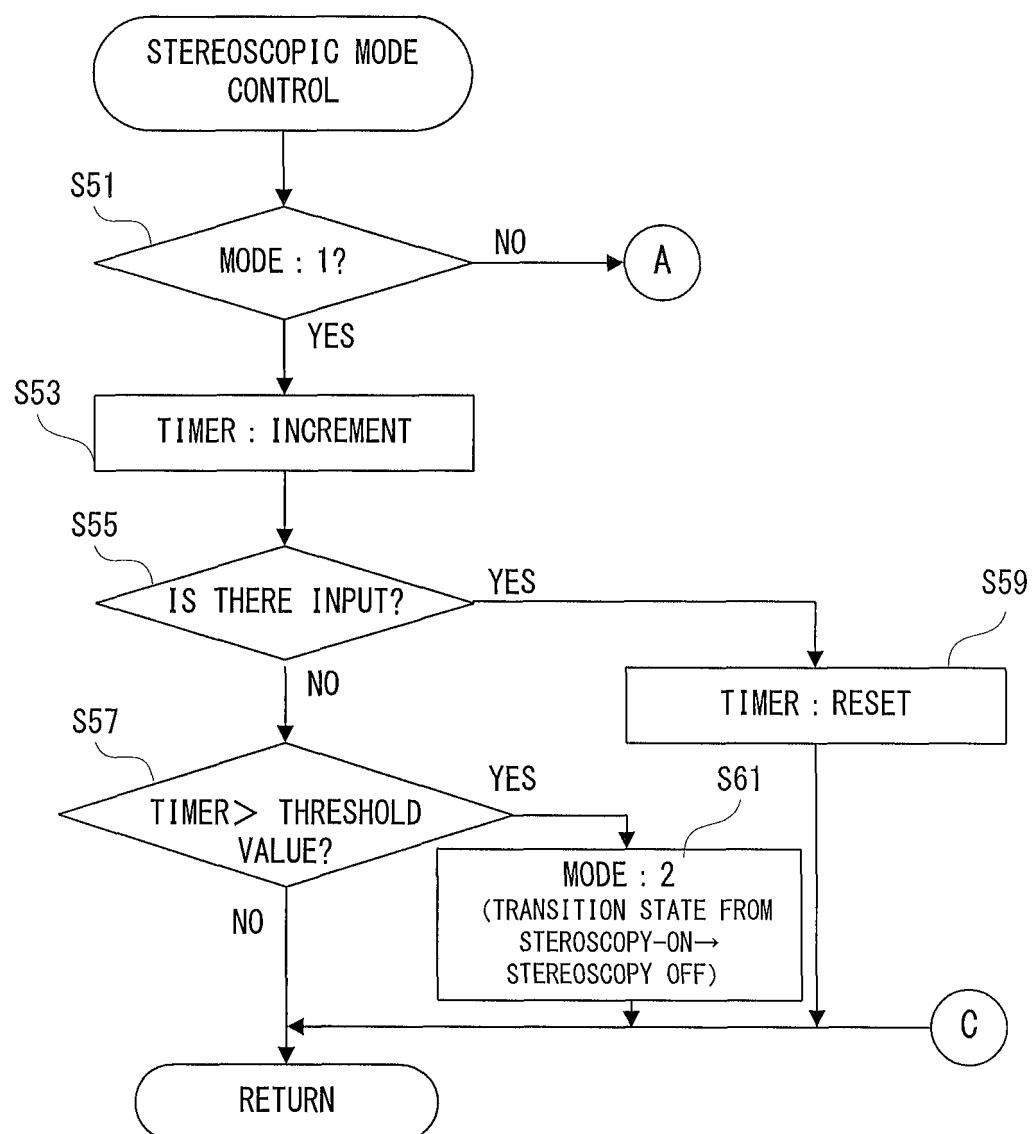


FIG. 16

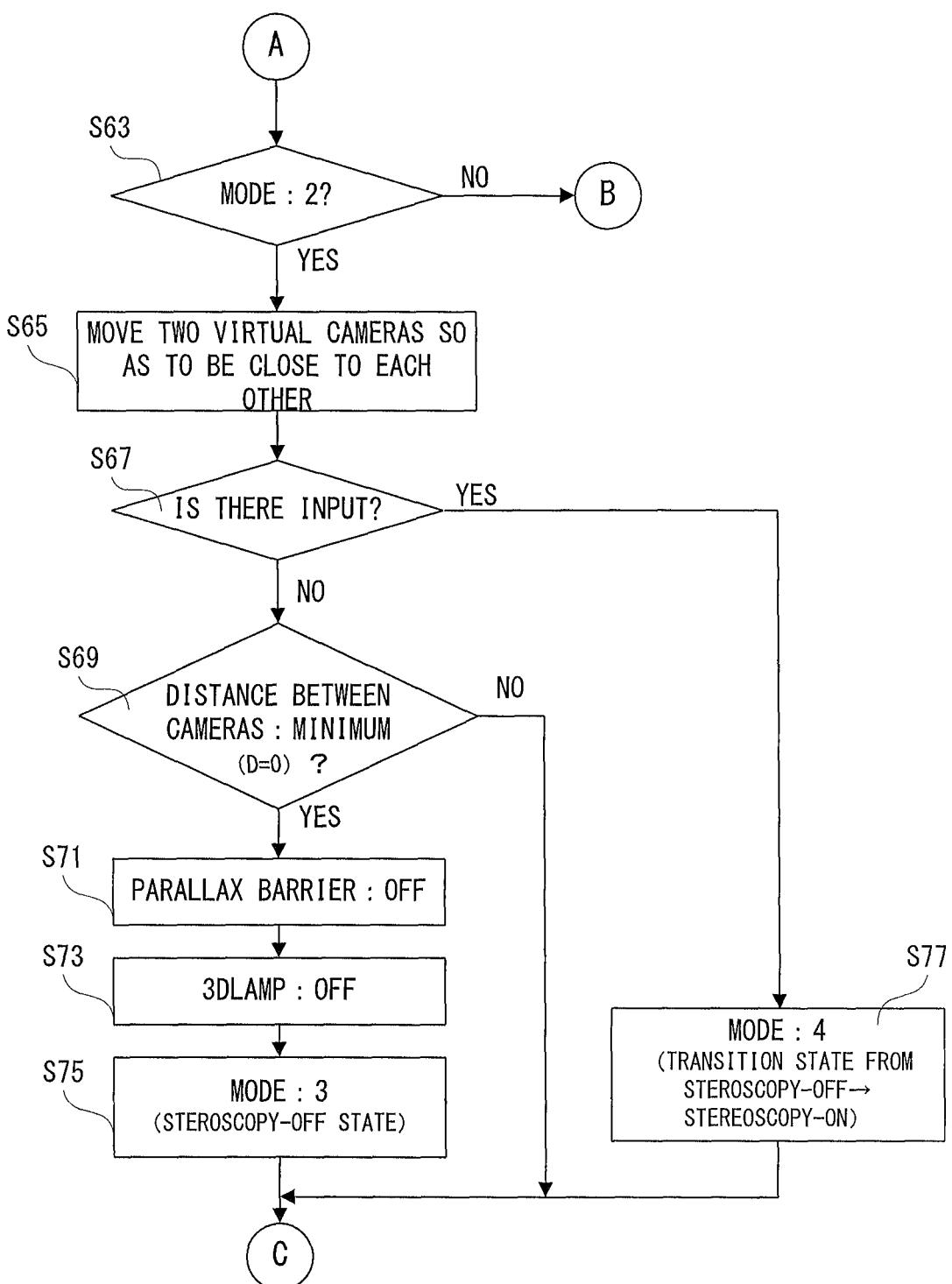
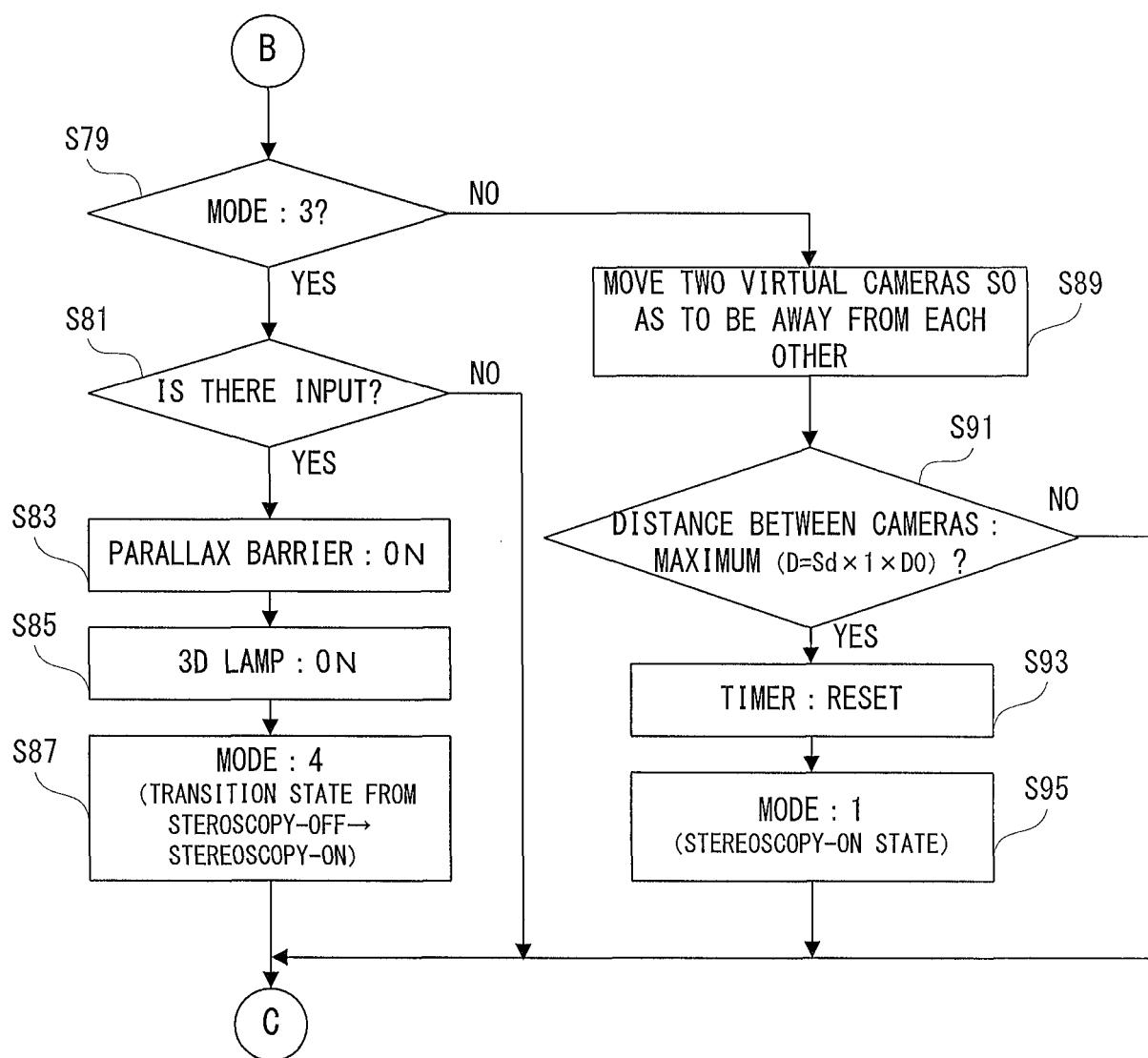


FIG. 17



REFERENCES CITED IN THE DESCRIPTION

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